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MANAGEMENT CONSULTING & RESEARCH, INC.

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TR-8706/17-1

COST MODEL/DATA BASE CATALOG
NON-DoD/ACADEMIC SURVEY

FINAL REPORT

VOLUME 1: PROJECT SUMMARY

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PREFACE

Management Consulting & Research, Inc. (MCR) has provided support to the Air Force Cost Center under contract F33657-85-D-0063/0017 issued 15 May 1987. The purpose of this project was to catalog the models and data bases being used for cost analysis within non-DoD Government agencies, Federally Funded Research and Development Centers (FFRDCs), and academic institutions. A previous project for the Cost Center cataloged the principal cost models and data bases within the Department of Defense and developed an automated cataloging system called CARRS.

This final report is presented in two volumes:

- Volume 1: Project Summary, and
- Volume 2: Final Data Base.

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I. INTRODUCTION

This technical report presents the results of the non-DoD cost model/data base survey effort. This introductory section provides an overview of the project and covers the:

- background,
- purpose of the project, and
- organization of the report.

A. BACKGROUND

Various cost organizations and product divisions within the Air Force are responsible for developing timely and accurate cost estimates for current and future United States Air Force (USAF) acquisition programs. These Air Force organizations have their counterparts in the other services as well as throughout the Federal Government. A wide variety of cost models and data bases are used to accomplish this cost estimating objective.

Many catalogs have been prepared on the models and techniques being used in the cost analysis community. During this and the previous effort, MCR looked at many of them. The majority of the studies were:

- limited in scope, either to a certain service or organization;
- confined to a certain subject area, such as software or logistics;
- concerned only with cost models; and
- addressed only automated models.

They varied in the type, amount and quality of information contained in them. There was no easy way to update them short of

performing another complete survey and it was impossible for an analyst to quickly search and find a particular tool.

It was felt that a PC-based, on-line catalog which was updated regularly, had the support and participation of the users, and that encompassed all areas of cost analysis would be of substantial benefit to all Government cost analysts. A comprehensive catalog of cost estimating resources would encourage:

- sharing of existing tools,
- development of new tools, where necessary, and
- consolidation of research efforts.

B. PURPOSE

The Air Force Cost Center undertook the task of developing a comprehensive catalog of cost analysis resources. This is the second task in the compilation of this catalog. The first task involved the surveying of the organizations within the Department of Defense and the collecting of descriptive information on the models and data bases used for cost analysis. A total of 341 cost tools from throughout DoD were described and cataloged. In order to facilitate the storage and retrieval of the survey information, an automated cataloging system, the Cost Analysis Resources Reference System (CARRS), was also developed.

In the current effort, Management Consulting & Research, Inc. (MCR) was tasked to survey organizations outside of the Department of Defense for cost models and data bases. Three areas were targeted as having the most potential for providing applicable resources for the catalog. They were:

- non-DoD Government agencies,
- Federally Funded Research and Development Centers,
and
- academic institutions.

It was envisioned that including these areas would provide new data sources and estimating techniques as well as establishing an information network throughout the Federal Government as well as the entire cost community.

An outline of the tasks and subtasks performed under this effort is shown in Exhibit I-1. The purpose of this report is to document the work performed under Task 1, Survey Non-DoD Cost Analysis Tools and Task 2, Survey Academic Institution Cost Analysis Tools. Work on the other two tasks, Task 3, Modify Cataloging Software and Task 4, Revise DoD Catalog, have been addressed elsewhere and are not included in this report.

C. ORGANIZATION OF THE REPORT

There are two volumes to this final report. Volume 1 presents the project methodology and summary of the survey results. Section II of Volume 1 presents a review of the cataloging process. Section III provides an overview of the final catalog including the DoD section. The next three sections describe the data collection strategy and results for the non-DoD Government agency survey, the FFRDC survey, and the academic institution survey, respectively. This report concludes with a section discussing MCR's observations and conclusions regarding the conduct of this effort.

TASK 1: SURVEY NON-DoD COST ANALYSIS TOOLS

- 1.1 IDENTIFY POTENTIAL SOURCES
- 1.2 MODIFY SURVEY FORMS AND WRITE LETTERS OF INTRODUCTION
- 1.3 SEND SURVEY FORMS
- 1.4 EVALUATE RESPONSES, MAKE FOLLOW-UP CALLS
- 1.5 VISIT TO COLLECT DETAILED SURVEY INFORMATION
- 1.6 ENTER DATA USING DEVELOPED SOFTWARE

TASK 2: SURVEY ACADEMIC INSTITUTION COST

- 2.1 ANALYSIS TOOLS
- 2.2 IDENTIFY POTENTIAL SOURCES
- 2.3 MODIFY LETTER OF INTRODUCTION
- 2.4 SEND SURVEY FORMS
- 2.5 EVALUATE RESPONSES, MAKE FOLLOW-UP CALLS
- 2.6 CALL/VISIT TO COLLECT ADDITIONAL SURVEY INFORMATION
- 2.6 ENTER DATA USING DEVELOPED SOFTWARE

TASK 3: MODIFY CATALOG SOFTWARE

- 3.1 DEVELOP REVISED SYSTEM DESIGN
- 3.2 MODIFY DATA BASE DESIGN
- 3.3 REVISE SOFTWARE PROGRAMS
- 3.4 TEST SOFTWARE
- 3.5 REVISE USER'S MANUAL

TASK 4: REVISE DoD CATALOG

- 4.1 SEND CATALOG TO DoD PARTICIPANTS FOR CORRECTIONS AND UPDATES
- 4.2 ENTER CHANGES USING DEVELOPED SOFTWARE
- 4.3 PROVIDE SYSTEM DEMONSTRATION AIDS TO AFCCE

Exhibit I-1. SUMMARY TASK OUTLINE

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There are five appendices to Volume 1 of this report. Appendix A contains a set of forms, revised from the first effort, used by MCR to collect the necessary information about the cost analysis tools and enter the information into the catalog. Appendix B contains the list of non-DoD and academic institutions which participated in the survey effort. Appendix C provides an alphabetical list of the cost analysis tools compiled during this effort. Appendix D contains a revised list of consistency checks that should be performed on the catalog after revisions are completed. Appendix E contains both an updated list of common abbreviations and acronyms used in the catalog descriptions and a list of key words. Appendix F provides the list of potential sources developed at the start of this effort.

The second volume is a printed copy of the final catalog records. The catalog is in numerical order by identification number. The structure of the identification number naturally groups all the models and data bases separately. With each of these sections, the catalog is further divided into organizational groupings, e.g., NASA, Department of Energy, etc.

II. OVERVIEW OF CATALOGING PROCESS

This section provides the reader with an overview of the complete cataloging process. It is based on the detailed survey plan followed during the first effort. The primary task under this current effort was to identify and survey all applicable non-DoD and academic organizations who might use cost models and data bases of interest to the Air Force and Federal Government and ascertain what resources might be available for Government use. MCR was then to develop detailed descriptions of these cost resources which would help an analyst determine the appropriateness of a particular tool for an application.

To accomplish this objective, MCR developed a set of seven steps for cataloging the non-DoD and academic organizations. These steps were:

- establish project scope,
- identify potential sources,
- review data collection criteria,
- develop data collection strategy,
- enter data using CARRS software, and
- verify catalog through participants.

The following subsections detail the cataloging plan and survey execution.

A. ESTABLISH PROJECT SCOPE

This project originally provided for the survey and cataloging of private industry in lieu of non-DoD Government agencies and FFRDCs. However, it soon became apparent from

initial meetings with potential industry sources that private industry was not likely to release information contained in their in-house cost data bases and models. The Cost Center was also reluctant to include commercially available models because no evaluation would be performed before entry into the catalog. Commercial models had been included in the previous effort only if the resource was used by the DoD activities surveyed.

At the start of the project, MCR met with the Cost Center staff to establish the scope of the project. During that meeting, it was decided to retain the criteria used during the first effort. A summary of the cataloging criteria is given in Exhibit II-1.

B. IDENTIFY POTENTIAL SOURCES

The next step consisted of developing target lists of academic institutions, non-DoD Government agencies and FFRDC organizations which might yield cost models and data bases useful to Government cost analysts. MCR's general approach was to use published references and referrals from the Air Force Cost Center, other DoD contacts and personal knowledge. The reference material used included:

- ISPA, ICA and ORSA-TIMS membership directories,
- Barron's Guide to Graduate Business Schools,
- Defense Management Education & Training (DOD 5010.16-C), July 1986,
- U.S. Army Formal Schools Catalog (DA PAM 351-4, January 1980), and
- the Federal Phone Directory, 1988.

- COLLECT INFORMATION ON EXISTING RESOURCES ONLY
- DEVELOP MODEL/DATA BASE DESCRIPTIONS ONLY
- ENCOMPASS ALL PHASES OF LIFE CYCLE
- COLLECT BOTH AUTOMATED AND NON-AUTOMATED TOOLS
- FOCUS ON AIRCRAFT, MISSILES, SPACE/SD SYSTEMS, ELECTRONICS, AND SOFTWARE

Exhibit II-1. SUMMARY OF PROJECT SCOPE

8706/17-1/003

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This research resulted in the generation of a candidate list of 902 possible sources, of which 872 were academic institutions. Because of the large number of academic institutions to be surveyed, it was decided to reduce this part of the list to the most likely sources for cost analysis tools. As a result, a list of 152 academic sources was developed. The short list of 152 was used as an indicator of the fruitfulness of this area. If survey results were promising, then the remaining 750 institutions from the initial list would be polled.

The preliminary list of potential sources was presented to the Cost Center for comment and approval. The final list, which incorporates the Cost Center's recommendations, is included as Appendix F.

As a supplement to the list, MCR performed searches through the Defense Technical Information Center (DTIC) and Naval Postgraduate School library. In addition, a listing of cost analysis works in the Air Force Institute of Technology (AFIT) at Wright-Patterson Air Force Base was requested.

C. REVIEW DATA COLLECTION CRITERIA

Initial contacts with potential sources and document searches provided over 1,027 candidate resources to evaluate. It became essential to review the resource selection criteria used during the previous study. These criteria served to:

- eliminate out of date and superseded tools, and
- include only the most useful tools for cost analysis.

The most important standard developed was the definitions of what a model and data base consisted of in a cost application.

- A "model" is one or more CERs or factors in which an analyst supplies certain variables and the model calculates a cost or other cost-related characteristic (e.g., manhours).
- A "data base" consists of a collection of information which has been or could be used to develop relationships or factors for analyzing cost. This includes cost data from contracts, cost/schedule reports and other sources, technical parameters and program data.

This was the foundation for the criteria that followed. In the previous effort, each candidate resource had to meet the criteria. As a result, the catalog contained:

- current tools (1975 to present),
- no general methodology studies,
- no generic spreadsheet "models," and
- no individual cost reports.

The reevaluation determined that this set of criteria had met its intended objectives stated above. To insure consistency throughout the CARRS data base these criteria were adopted for use in evaluating resources for inclusion during this effort as well.

D. DEVELOP DATA COLLECTION STRATEGY

The approach used to locate and collect the required information for this effort was critically important to the success of this effort. During the previous effort, MCR had used a number of different approaches tailored to the individual organization being dealt with. The knowledge gained during the previous effort was used to formulate the best strategy for each

organizational category. Each category (non-DoD Government Agencies, FFRDCs and academia) was evaluated on a number of factors. They were:

- the number of individual organizations to be contacted,
- the projected number of resources to be collected,
- the type of resources to be collected,
- whether points of contact had been identified, and
- estimated difficulty of obtaining information.

Based on these factors, there are three basic approaches that could be used alone or in combination. They are:

- mail survey,
- phone survey, and
- personal visit.

A mail survey is best when there is a large number of organizations to poll, such as within the academic community, where the number and type of resources is not known and/or where no points of contact have been identified. A phone survey is the best approach when the sample size is small to average, points of contact are known and the amount of cost resources to collect is small for each contact. On the other hand, a personal visit is justified when the sample size is small, the points of contact known and the number of resources is large.

A different tactic for each organizational category, based on its characteristics, was formulated using combinations of these three approaches. The strategy used for each organizational category is detailed in Sections IV through VI describing each category's cataloging results.

E. ENTER DATA USING CARRS SOFTWARE

After completion of the data collection, the model and data base information from the data collection Resource Worksheet was reduced to its final form and transferred to a Data Entry Worksheet. The information on the worksheets was entered into the catalog using the CARRS software. After entry, the information was checked for consistency and accuracy, and any necessary changes were made using the edit/delete options of the Catalog Maintenance Menu. MCR used the key word list generated from the previous effort, with additions and modifications to accommodate the new resources, to assign key words/phrases that describe each resource. The revised key word list can be found in Appendix E.

F. RECYCLE CATALOG THROUGH PARTICIPANTS

Because of the short time available at the end of this project, only the organizations requesting review were included in the recycle phase. They were:

- George C. Marshall Space Flight Center,
- Jet Propulsion Laboratory,
- Aerospace Corporation,
- the MITRE Corporation, and
- the Bureau of Economic Analysis.

After completion of the organization's catalog entries, a copy of the records were printed. The entries were sent by telephone facsimile machine to the major point of contact within each of the five organizations. The POC coordinated the recycling effort within the organization and distributed the individual entries to the applicable point of contact for

revisions. Each POC was asked to look through the listing submitted to them and make any corrections or updates to the model and data base entries. They were also asked to indicate any models/data bases that were no longer used and should be deleted from the catalog.

III. FINAL CATALOG RESULTS

This section provides a top-level discussion of the resulting CARRS catalog. It presents both:

- the results of the non-DoD and academic effort, and
- a breakout of the combined CARRS catalog.

A. NON-DoD AND ACADEMIC EFFORT

During this effort, 168 non-DoD and academic cost models and data bases were added to the existing DoD catalog. An additional 101 resources were collected but were not included because they were either missing critical information which could not be collected or they were judged to be not appropriate. The total number of resources cataloged for each category was:

- non-DoD Government agencies -- 67,
- FFRDCs -- 43, and
- academic institutions -- 59.

A breakout of the resources by organization is included as Exhibit III-1.

Of the 168 cost tools cataloged, 27 are data bases and 141 are models. 62%, or 101 resources, are obtainable without restriction, 63 are obtainable on a case-by-case basis and 2 are listed as not obtainable. Almost 93 percent of the resources collected have some form of documentation and over 40 percent of them are automated. The automated figure is low because many of the resources were cataloged from DTIC documentation where automation information was not available. These resources are

Air Command and Staff College (ACSC) -- 2
 Air Force Institute of Technology (AFIT) -- 12
 Air Force Business Research Management Center -- 1
 Aerospace Corporation -- 4
 Air University -- 1
 Bureau of Economic Analysis (BEA)/Commerce -- 4
 Center for Naval Analyses (CNA) -- 4
 Congressional Budget Office/NSD -- 1
 Department of Energy (DOE) -- 5
 Defense Systems Management College (DMSC) -- 9
 Federal Aviation Administration (FAA) -- 1
 General Services Administration (GSA) -- 5
 George Mason University -- 1
 George Washington University -- 1
 Harvard University -- 1
 Institute for Defense Analysis (IDA) -- 2
 MITRE Corporation -- 10
 National Aeronautics and Space Administration (NASA) -- 50
 Ames Research Center (ARC) -- 3
 Goddard Space Flight Center (GSFC) -- 4
 Jet Propulsion Laboratory (JPL) -- 17
 Langley Research Center (LRC) -- 6

Exhibit III-1. NON-DoD AND ACADEMIC CATALOG
 RESULTS BY ORGANIZATION

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Marshall Space Flight Center (MSFC) -- 18
Advanced Concepts & Missions Division (OART) -- 1
Office of Manned Space Flight (OMSF) -- 1
National Bureau of Standards (NBS) -- 1
Naval Postgraduate School (NPGS) -- 24
National Defense University -- 1
The Rand Corporation -- 23
US Army Management Engineering College -- 1
University of Alabama -- 1
University of Cincinnati -- 2
University of Mississippi -- 1

Exhibit III-1. NON-DoD AND ACADEMIC CATALOG
RESULTS BY ORGANIZATION (CONT'D)

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listed as unknown. A complete breakout of this part of the catalog is given in Exhibit III-2.

B. COMBINED CARRS CATALOG

The results of this effort were added to the data base containing the DoD resources. The resulting catalog contains a total of 505 cost analysis tools. An alphabetical listing of the non-DoD and academic resources added to the catalog can be found in Appendix C. There are a total of 105 data bases and 400 models. 55 percent, or 280 resources, are obtainable without restriction, 107 are obtainable on a case-by-case basis and 5 are listed as not obtainable. A complete breakout of the entire catalog is given in Exhibit III-3. A breakout of the models and data bases by organization category is shown in Exhibit III-4. A determination was made during the project, with Cost Center concurrence, to include the DoD-related academic institutions under their service designators, e.g., Naval Postgraduate School under Navy, AFIT under Air Force. This is reflected in the category breakout. A combined breakout of the models and data bases by key words is shown in Exhibit III-5. Each cost tool can have up to 10 key words associated with it. Therefore, the numbers in Exhibit III-5 will not add to the totals given in Exhibit III-3.

This project targeted three distinctly different areas to investigate for cost models and data bases. Those differences

	<u>Models</u>	<u>Data Bases</u>
Total	142	26
Obtainable	91	11
Documented	137	20
Classified	0	0
Proprietary	39	14
Automated	52	16

Exhibit III-2. NON-DoD AND ACADEMIC CATALOG BREAKOUT

MANAGEMENT CONSULTING & RESEARCH, INC.

	<u>Models</u>	<u>Data Bases</u>
Total	400	105
Obtainable	230	50
Documented	363	88
Classified	15	10
Proprietary	77	36
Automated	218	47

Exhibit III-3. COMPLETE CATALOG BREAKOUT

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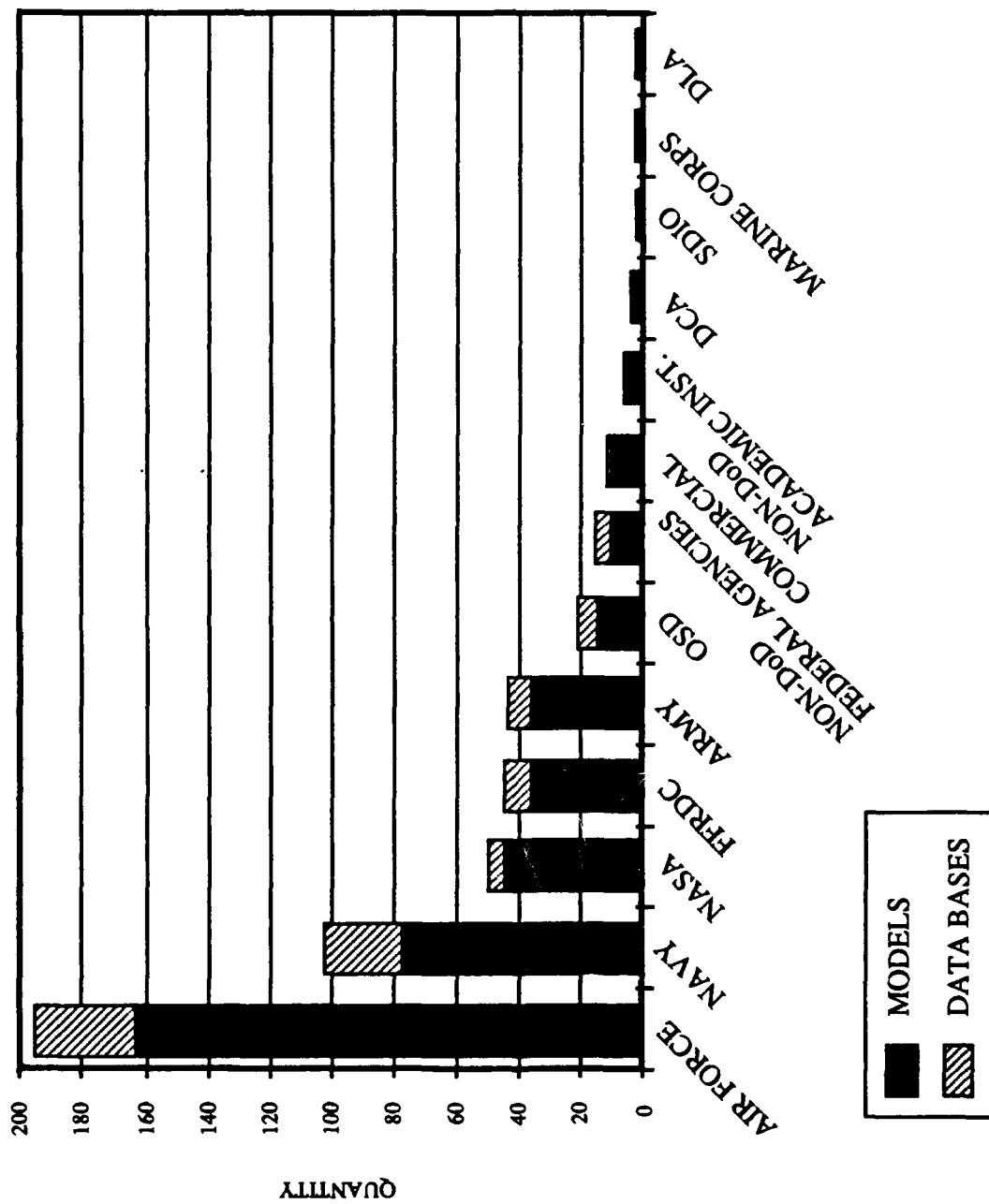


Exhibit III-4. CATALOG BREAKDOWN BY ORGANIZATIONAL CATEGORY

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<u>KEY WORD</u>	<u>NO. OF MODELS</u>	<u>NO. OF DATA BASES</u>
Acquisition Strategy	4	0
Ada	1	1
Aircraft	91	30
Airframes	17	9
Analog Techniques	7	2
Armament	2	3
Artificial Intelligence/Expert Systems	1	0
Avionics	31	8
C3I	0	1
CERs	196	6
Command & Control Systems	4	1
Communications	15	5
Competition Analysis	3	0
Composites	6	3
Computer	6	2
Construction Costs	18	3
Contract Analysis	3	3
Contractor Data Analysis	7	13
Cost Data	33	90
Cost Estimates/Analyses	343	4
Cost Factors	48	4
Cost/Benefit Analysis	9	0
Curve Fitting	10	0
Data Base	19	102
Econometric Forecasting	9	0
Economic Analysis	13	0
Electro-optical	7	1
Electronic Warfare	4	2
Electronics	49	18
Engineering	12	1
Engineering Build-up Techniques	15	1
Engineering Change Orders (ECO)	2	0
Engines	22	10
Equipment Hour Data	0	3
Escalation/Inflation Factors & Indices	12	1
Facilities	24	3
Financial Analysis	8	2
First Destination Transportation Costs	3	2
Flyaway	7	2
Forces	11	0
Functional Cost Breakdown	27	4
Government Furnished Equipment (GFE)	0	1
Helicopter	10	6
Indirect Costs	2	0
Installation	5	2
Integrated Logistic Support (ILS)	26	2
Integration & Assembly	1	0
Labor Hour Data	9	17
Labor/Materials Breakdown	12	4
Laser	6	2
Launch Vehicles	5	0

Exhibit III-5. CATALOG BREAKOUT BY KEY WORD

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<u>KEY WORD</u>	<u>NO. OF MODELS</u>	<u>NO. OF DATA BASES</u>
LCC	69	3
Learning Curves	17	2
Lease Costs	3	0
Maintenance	21	2
Management Reserve	2	0
Manpower Data	1	2
Manpower Estimates/Analyses	28	0
Manpower Estimating Relationships (MERs)	12	0
Manufacturing	11	2
Missiles	36	14
Modification Costs	10	5
Modifications	6	1
Monte Carlo Simulation	10	0
Munitions	8	1
Navigation	2	2
Nonrecurring/Recurring Breakdown	18	1
O&S Costs	71	12
Overhead	6	3
Parametric Techniques	103	0
Performance Assessments	11	2
Personnel	21	2
Planning Factors	1	1
Planning/Programming/Budgeting	23	0
Precision-Guided Submunitions	1	1
Prime Mission Equipment (PME)	5	0
Procurement Support	9	0
Production Costs	129	39
Profit	1	0
Program Data	5	23
Prototype	5	0
R&D Costs	110	34
Radar	12	7
Requirements Estimates/Analyses	20	0
Risk Analysis	9	0
RPV	2	0
SAR Analysis	1	0
Schedule Data	1	13
Schedule Estimates/Analyses	22	2
Schedule Estimating Relationships (SERs)	4	0
Sensor	3	2
Ships	12	9
Site Activation	1	0
Software	30	8
Software (Embedded)	12	2
Software Sizing	4	4
Sonar	0	1
Space Systems	38	8
Spacecraft	42	8
Spares	22	3
Statistical Analysis	39	1
Strategic Defense	4	3

Exhibit III-5. CATALOG BREAKOUT BY KEY WORD (CONT'D)

MANAGEMENT CONSULTING & RESEARCH, INC.

<u>KEY WORD</u>	<u>NO. OF MODELS</u>	<u>NO. OF DATA BASES</u>
Support Equipment	14	3
System Level Breakdown	11	0
Technical Characteristics Data	34	45
Test & Evaluation	7	0
Tooling & Test Equipment	11	1
Training	8	3
Vehicles (Tracked)	0	3
Vehicles (Wheeled)	1	2
Warranty Costs	2	1
WBS	27	6
Weapon Systems	22	6
Weight Estimating Relationships (WERS)	6	0

Exhibit III-5. CATALOG BREAKOUT BY KEY WORD (CONT'D)

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led MCR to formulate three distinct data collection plans. The next three sections describe the survey effort for each organizational area. Since each had its own problems and solutions each area is discussed within its own report section.

IV. NON-DoD GOVERNMENT AGENCY SURVEY RESULTS

The non-DoD Government agencies were a major focus of this effort. Not only was it hoped that they would provide an untapped source of cost models and data bases, but the survey was seen as an opportunity to establish a cost analysis information network throughout the Federal Government. During this effort, 20 agencies were contacted. A listing of those agencies is given in Exhibit IV-1. This part of the report provides a detailed description of the cost cataloging procedures for these agencies. Specifically, it addresses the:

- data collection strategy, and
- cataloging results.

A. DATA COLLECTION STRATEGY

The results of the preliminary analysis indicated that there could be a large number of applicable cost resources in the non-DoD agencies. However, there were no identified points of contact within any of these organizations. Experience from the DoD effort suggested that it would be difficult to obtain the detailed information needed because of the severe constraints on participant's time. Therefore, a four step approach was adopted. The approach entailed:

- identifying applicable offices within each agency and sending a letter of introduction,
- following up the mailing with phone calls to identify points of contact and to schedule briefings,

- Applied Physics Laboratory
- Bureau of Economic Analysis, Department of Commerce
- Congressional Budget Office
- Defense Advanced Research Projects Agency (DARPA)
- Department of Commerce
- Department of Energy
- Department of Transportation
- Federal Aviation Administration
- General Services Administration
- MIT-Lincoln Laboratory
- National Aeronautics and Space Administration
 - George C. Marshall Space Flight Center
 - Jet Propulsion Laboratory
- National Bureau of Standards
- National Technical Information Service
- Office of Management and Budget
- Lawrence-Livermore Laboratory
- Bureau of Labor Statistics, Department of Labor
- Small Business Administration
- Bureau of Land Management

Exhibit IV-1. NON-DoD GOVERNMENT AGENCIES SURVEYED

MANAGEMENT CONSULTING & RESEARCH, INC.

- visiting agencies to present briefings and demonstrate CARRS, and
- performing the detailed cataloging by phone or personal visit.

The Federal Phone Directory was used to help identify cost, budget, and/or comptroller offices within the various agencies. If no particular office or offices could be identified, the information office or head of the agency was selected. A letter of introduction was sent to all potential sources. This letter explained the project in detail and requested participation in the cataloging effort.

The mailing was followed up with phone calls to the office of the agency addressee. The addressees were asked if they had received the letter and if the correct person or office had been contacted. If the letter had been referred to another office or offices, those names and phones numbers were obtained. When the appropriate party was located, the project was explained and any questions about the survey were answered. In addition, MCR offered to brief them and any other interested agency personnel on the objectives of the project and provide a CARRS demonstration. As a result of these calls, briefings were provided to the:

- Department of Energy,
- Congressional Budget Office,
- Commerce Department,
- National Bureau of Standards,
- Bureau of Economic Analysis,
- Department of Transportation,

- National Aeronautics and Space Administration,
- Office of Management and Budget, and
- Bureau of Labor Statistics.

At least one member of the Air Force Cost Center staff accompanied the MCR cataloging team on these briefings. The briefings followed the same general format. A member of the Cost Center staff would give a presentation on the Cost Center and would introduce the current effort. The MCR team would then present a briefing on the background and benefits of the cost catalog and a short demonstration of the capabilities of the CARRS software. The Air Force Cost Center offered all Government agencies a copy of CARRS.

A few days after the briefing the agency POCs were contacted to determine if they had models and data bases at the agency to be cataloged. If there were less than three resources to be collected, the descriptions were worked up over the phone. If there were three or more resources to be cataloged, an appointment was made to visit and collect the needed information. A Resource Worksheet was developed for every cost tool that met the collection criteria. MCR developed the detailed descriptions primarily through user documentation supplied to us by the point of contact during our visit.

From contacts with the various NASA labs and organizations, it was eventually determined that the George Marshall Space Flight Center develops the majority of NASA's cost tools and provides them to the other NASA organizations. None of the other organizations except JPL develop their own cost tools. Therefore

only two trips were planned for collecting NASA cost tools: one to Marshall Space Flight Center and one to the Jet Propulsion Laboratory.

Any cataloging which required significant travel, such as the Jet Propulsion Laboratory and Marshall Space Flight Center, was postponed until all contacts had been made. The trips were then combined. Only two data collection trips were made during this effort. One trip was made to the George C. Marshall Space Flight Center in Huntsville, Alabama and the other to the Jet Propulsion Laboratory in Pasadena, California. The west coast trip was combined with travel to the Naval Postgraduate School, the Rand Corporation, and the Aerospace Corporation.

B. CATALOGING RESULTS

Efforts in this area provided a total of 67 resources; 54 models and 13 data bases. They were distributed among the organizations as follows:

- National Aeronautical Space Administration (NASA)
-- 50,
 - George C. Marshall Space Flight Center -- 18,
 - Jet Propulsion Laboratory -- 17,
 - Langley Research Center -- 6,
 - Goddard Space Flight Center -- 4,
 - Ames Research Center -- 3,
 - OART (Advanced Concepts & Missions Div.) -- 1,
 - Office of Manned Flight -- 1;
- General Services Administration -- 5;
- Department of Energy -- 5;

- Congressional Budget Office -- 1;
- Federal Aviation Administration -- 1;
- National Bureau of Standards -- 1; and
- Bureau of Economic Analysis -- 4.

All of the Government agencies contacted were very interested in the cataloging effort. However, most of the agencies used either commercial models, project specific models or analogies to develop their estimates and could not provide us with any cost resources. Estimates in most of the agencies were reactionary in nature, and for one of a kind systems or off-the-shelf items. The typical tasks do not provide enough lead-time or enough information to develop a data base or general model.

MCR was unable to brief and catalog the Federal Aviation Administration and the General Services Administration because of scheduling difficulties. However, five models previously identified during initial contacts were obtained from GSA through phone interviews.

V. FFRDC SURVEY RESULTS

The Federally Funded Research and Development Centers are private organizations whose study programs are funded and controlled by the Federal Government. The previous DoD survey provided a large number of models and data bases which had been developed by FFRDCs. Therefore, it was felt that this area would provide many additional resources not uncovered during the previous effort as well as internal research and development work. It also provided an opportunity to update the existing catalog entries with more complete descriptions and/or current points of contact. A listing of the FFRDCs is given in Exhibit V-1.

This part of the report provides a detailed description of the cost cataloging for this area. Specifically, it addresses the:

- data collection strategy, and
- cataloging results.

A. DATA COLLECTION STRATEGY

The results of the preliminary analysis indicated that there could be a substantial number of applicable cost resources within this area. Through its work in cost analysis and professional associations, MCR was able to develop a list of points of contact for each FFRDC.

- The Aerospace Corporation
- Center for Naval Analyses
- Institute of Defense Analyses
- Logistics Managment Institute
- The MITRE Corporation
- Rand Corporation

Exhibit V-1. FFRDC LISTING

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A three step approach was used. The strategy involved:

- contacting individual points of contact by phone to explain project and set up briefing,
- visiting the FFRDCs to present briefings and demonstrate CARRS, and
- performing the detailed cataloging by phone or personal visit.

Each FFRDC was contacted by phone to explain the project and solicit their participation. If possible, an appointment was made to present a briefing and CARRS demonstration. The Center for Naval Analyses (CNA) was, at the time of contact, participating with the Naval Center for Cost Analysis on a parallel project to collect Navy models. Their cost resources would be submitted through that effort and they were therefore dropped from the survey. In addition, the Logistics Management Institute was cooperative but could not provide any resources to the catalog. They also declined the briefing for that reason.

As a result of these calls, briefings were provided to the:

- Aerospace Corporation,
- MITRE Corporation (Washington, D.C. office), and
- Rand Corporation.

As with the non-DoD Government agencies, at least one member of the Air Force Cost Center accompanied the MCR project team on these briefings. The briefings also followed the same format. A member of the Cost Center would give a presentation on the Cost Center and would introduce the current effort. The MCR team would then present a briefing on the background and benefits of the cost catalog and a short demonstration of the capabilities of

the CARRS software. The Air Force Cost Center offered all participating FFRDCs a copy of CARRS.

Three of the FFRDCs, the Rand Corporation, the Aerospace Corporation and MITRE (Bedford) were located outside the Washington, D.C. area. To minimize travel expenses the briefing and detailed cataloging were combined into a single trip. The trips to these locations were also combined with travel to the Jet Propulsion Laboratory and Naval Postgraduate School.

A few days after the briefing, the FFRDC points of contact were contacted to determine if they had models and data bases to be cataloged.

B. CATALOGING RESULTS

The survey yielded 43 cost resources. There were 34 models and 9 data bases. They were distributed among the organizations as follows:

- Rand Corporation -- 23
- Aerospace Corporation -- 4
- MITRE Corporation -- 10
- Center for Naval Analyses -- 4
- Institute of Defense Analyses -- 2

These numbers do not include any resources in which the FFRDC was developer, but not designated as controlling activity or point of contact.

Because of scheduling difficulties, MCR was unable to brief MITRE in Bedford, Massachusetts. However, five cost tools were obtained from them through telephone interviews with contacts supplied to us by Mr. Bill Hutzler at MITRE (Washington, D.C.).

VI. ACADEMIC INSTITUTION SURVEY RESULTS

This category included both DoD-related institutions, such as the Defense Systems Management College (DSMC), and private universities and colleges. It was hoped that a survey in this area would uncover untapped sources of cost models and data bases as well as provide unique approaches to solving estimating problems. A listing of the institutions polled is given in Exhibit VI-1.

This part of the report provides a detailed description of the cost cataloging for this segment of the effort. Specifically, it addresses the:

- data collection strategy, and
- cataloging results.

A. DATA COLLECTION STRATEGY

MCR had identified 152 institutions which were likely candidates for inclusion in the survey. This list was composed of the major DoD schools, private schools with cost estimating curricula, and major institutions with Operations Research or other related degree programs. Only a few points of contact could be established within the different institutions prior to sending the initial survey letters. Those who were known in advance tended to be clustered in the DoD-related schools.

The data collection strategy initially planned for this area involved an initial mail-in survey to candidate institutions followed by a detailed cataloging effort based on survey responses. Detailed cataloging would consist of:

Air Force Institute of Technology
 Arizona State University
 Bentley College
 Brown University
 California State Polytechnic
 University/Pomona
 California State University
 at Los Angeles
 Career Development Institute
 Carnegie-Mellon University
 Case Western Reserve University
 Central Michigan University
 Chapman College
 Clarkson University
 Clemson University
 Cleveland State University
 Colorado State University
 Columbia University
 Cornell University
 Defense Institute of Security
 Assistance Management (DISAM)
 Defense Security Institute (DSI)
 Defense Systems Management
 College (DSMC)
 Embry-Riddle Aeronautical
 University
 Florida Institute of Technology
 Florida State University
 George Washington University
 Georgia College
 Georgia Institute of Technology
 Harvard University
 Indiana University
 James Madison University
 Lebanon Valley College
 Louisiana State University
 Louisiana Tech University
 Mississippi State
 MIT
 Monmouth College
 National Defense University
 Naval Postgraduate School
 Oregon State University
 Our Lady of the Lake University
 Pennsylvania State University
 Rensselaer Polytechnic Institute
 Rice University
 San Jose State University
 Sangamon State University
 Southeast Institute of Technology
 Southwest State University
 Southwest Texas State University
 Stanford University

State College, Pennsylvania
 SUNY-Stony Brook
 Texas A&M University
 The University of Montevallo
 Tripler Army Education Center
 USAF Academy
 U.S. Army Command and General
 Staff College
 U.S. Army Defense Ammunition
 Center & School
 U.S. Army Facilities Engineering
 Support Agency
 U.S. Army Logistics Management
 Center (ALMC)
 U.S. Army Management Engineering
 Training Activity (AMETA)
 U.S. Army Transportation School
 U.S. Army War College (USAWC)
 U.S. Military Academy
 University of Alabama
 University of Alabama in
 Birmingham
 University of California-San Diego
 University of Chicago
 University of Cincinnati
 University of Connecticut
 University of Dallas
 University of Dayton
 University of Florida
 University of Hawaii
 University of Louisville
 University of Maryland
 University of Miami
 University of Michigan
 University of Mississippi
 University of Missouri
 University of Missouri-Columbia
 University of Notre Dame
 University of Oklahoma
 University of Pennsylvania
 University of Pittsburgh
 University of San Francisco
 University of Texas at Dallas
 University of Toledo
 University of Virginia
 University of Wisconsin-Milwaukee
 W. Paul Stillman School of
 Business
 Washington State University
 Washington University
 Webster College
 Western New England College
 Wright State University

Exhibit VI-1. ACADEMIC INSTITUTIONS SURVEYED

MANAGEMENT CONSULTING & RESEARCH, INC.

- phone interviews for one to three resources,
- mail Resource Worksheets to POC for three to ten resources, and
- data collection visits for over 10 resources.

Each institution was sent an initial survey package. The package consisted of a letter of introduction explaining the effort, an initial survey form similar to the one used in the last effort, and a brochure on the CARRS catalog and software. The results of this initial survey were very disappointing. Of the 152 surveys mailed only 10 responses were received. However, 74 candidate cost tools were identified from those responding. This prompted a reevaluation of our original strategy.

An appraisal of the 10 responses was made using three criteria:

- the number of DoD-related responses versus private institution responses.
- the type of resources provided, and
- the quality of resources relative to the collection criteria.

This analysis showed that, as expected, the DoD-related organizations provided the best probability of yielding applicable resources for use by Government cost analysts. Based on these results, MCR decided to split the academic effort into two parts: a DoD-related segment and a private institution segment.

For the DoD-related segment of the cataloging effort, it was decided to conduct an initial interview over the phone, since a point of contact had been identified for most of them. The points of contact were asked if they had received the initial survey and if so, were they the correct person or department to

contact. If the survey had been referred to another department those names and phone numbers were obtained. When the appropriate party was located, the project was explained and any questions about the survey was answered. An initial canvassing of potential resources was then made. If likely models and/or data bases were identified, arrangements were made at that time to collect the detailed information. The arrangements varied depending on the point of contact and number of tools. However, it closely followed the detailed collection strategy generated at the start of the academic survey and listed above.

A different tack was taken for the 112 private institutions. It was decided to send this segment a second mailing of the initial survey. However, the cover letter in this package requested the return of negative responses and included a self-addressed stamped return envelope. This mailing resulted in 48 responses with 8 additional candidate cost tools identified.

Each respondee was then contacted by telephone to make arrangements for the detailed cataloging. There were no data collection visits planned for the private institutions. All cataloging was performed via telephone interview or mail.

To supplement the direct survey, MCR also performed document searches through the Defense Technical Information Center (DTIC) and the Naval Postgraduate School library. Research report abstracts were also obtained from AFIT and a 1982 abstract report was located for Air University.

Several searches were made through DTIC on various criteria. During analysis of the resulting abstracts, discrepancies were

noted between the reports. For example, cost models that had been listed with the abstracts from a Naval Postgraduate School cost model search was not listed under the general cost model search and vice versa. This led MCR to contact DTIC to resolve the differences. A DTIC representative told us that frequently a search is not completed because the abstract report is stopped after it reaches an arbitrary size. It was also noticed from the various listings that there is no consistency check of the key words submitted by the document author. Reports that were obviously developing cost models were not listed as such. In the previous effort, MCR had noted that there is a significant time lag between publication and availability in DTIC.

B. CATALOGING RESULTS

This part of the effort resulted in a total of 59 cost tools composed of 55 models and 4 data bases. They were distributed among the organizations as follows:

- Defense Systems Management College (DSMC) -- 9
- Naval Postgraduate School -- 24
- Air Force Institute of Technology -- 12
- Air University -- 1
- Air Command and Staff College -- 2
- Air Force Business Research Management Center -- 1
- George Mason University -- 1
- George Washington University -- 1
- Harvard University -- 1
- National Defense University -- 1
- U.S. Army Management Engineering College -- 1

- University of Alabama -- 1
- University of Cincinnati -- 2
- University of Mississippi -- 1

The Air Force Cost Center intends to survey the AFIT and Air University libraries and therefore MCR did not collect resources archived there. Resources from these institutions included in the catalog were ones obtained through DTIC or through MCR's resource library. Neither of these sources was complete or current (beyond 1986).

VII. OBSERVATIONS AND CONCLUSIONS

This study provided a unique opportunity to assess the direction and progress of cost analysis outside of the Department of Defense. It reaffirmed the belief that the Department of Defense is a leader in cost research. This may be due to the fact that most non-DoD acquisition involves off-the-shelf or one of a kind items. These types of procurements favor analogy or "grass roots" estimating. Only those agencies, such as NASA and DOE, that directed major acquisitions of equipment did any applicable cost research work.

MCR also observed, in the course of this effort, the lack of communication between the different organizations within the cost community. This was true even between different divisions in the same organization. There was no network in place to facilitate the exchange of valuable cost information. If this project had accomplished nothing else, it did provide a vehicle, through CARRS, for improved communication. A network between the Air Force and other DoD organizations, non-DoD Government agencies, FFRDCs and major academic institutions has been established through the points of contact identified during this and the last effort.

This effort did not encounter the problems experienced during the DoD effort for two major reasons. First, MCR's experience from the previous effort enabled us to anticipate problems and correct them before they impacted on the project. For example, only automated cost tools were specified in the initial survey responses on the DoD effort. We had to compensate

by collecting non-automated tools through the cost libraries. During this effort we strongly emphasized the collection of non-automated resources in all of our correspondence and briefings.

Second, during this effort the project team was kept small and consisted only of staff members who had worked on the DoD catalog. They were all experienced cost analysts. A stable data collection team provided more consistent, higher quality results. Less time was required to process and enter the data.

Even though CARRS provides an automated framework for entering the cataloging information into the system, the process of preparing the information for entry and ensuring the consistency of the data base is a very time consuming and labor intensive task. It takes between thirty minutes and an hour to review a single document and write a complete description. Preparing that description for data entry and generating applicable key words can take as long as an hour. Entering that document into the system takes anywhere from five to fifteen minutes. That record must then be proofed and edited. The entire catalog must be checked for consistency before release. The whole process can require as much as four hours per record.

The importance of well-trained personnel, in both cost analysis and the CARRS software, in the successful maintenance of this catalog can not be stressed enough. The usefulness of this catalog depends on the quality and accuracy of its information. The user must rely on the expertise of the maintenance personnel to supply the accurate information needed to evaluate the cost tools contained in the catalog.

Therefore, MCR recommends that a CARRS support team be established within the Cost Center. This team should be made up of two to five staff members. At least one member should be an experienced cost analyst who is familiar with the use of models and data bases. The group should be thoroughly trained on the CARRS software and its maintenance procedures. Each team member would then be available to answer questions, solve problems and work on the periodic updates. This would greatly reduce the amount of time each member would have to spend in support of CARRS and insure consistency of the catalog.

In summary, 168 major non-DoD and academic cost tools were added to the existing DoD catalog. Although an attempt was made to survey all of the organizations targeted, MCR was unable to arrange briefings or data collection for FAA, MITRE (Bedford, Massachussetts), and GSA due to scheduling problems. In addition, MCR did not survey the AFIT and Air University libraries. All five of these sources have the potential of providing a large number of applicable cost tools for the catalog. It is hoped that the contacts established during this effort for these organizations will be utilized at some later time to add their models and data bases.

APPENDIX A
REVISED DATA COLLECTION AND ENTRY WORKSHEETS

**AIR FORCE
COST MODEL/DATA BASE CATALOG
RESOURCE WORKSHEET**

☐ Data Base

☐ Model

Security Classification (U,P,C,S): _____

Title: _____

Controlling Activity: _____

Point of Contact: _____

Phone Number: (____) _____

Mailing Address: _____

Resource Obtainable (Y/N): _____ Applicable Call Number: _____

Resource Developer: _____

Implementation Date: _____ Date of Last Update: _____

DOCUMENTATION:

Does Documentation Exist? (Y/N): _____

Document Title	Available	Collected

Description/Uses: _____

Special Features: _____

Limitations: _____

(user costs, _____

upgrades) _____

AUTOMATION:

Automated (Y/N)? _____

Equipment: _____

Operating System: _____

Memory Requirements: _____

Programming Language: _____

Key Words (list up to 10)

1. _____ 6. _____

2. _____ 7. _____

3. _____ 8. _____

4. _____ 9. _____

5. _____ 10. _____

ADDITIONAL COMMENTS:

ID Number: _____

Resource Type (M.D.): ☐

Security Classification (U,C,S,P): |

Resource Name: _____

Organization Designation (e.g. F.A.N.M): |

Controlling Activity:

POINT OF CONTACT

Title:

Last Name:

Phone Number:

Address:

Resource Obtainable (Y,C,N,U):

Call Number:

Resource Developer: <div style="border-bottom: 1px solid black; height: 1.2em; width: 100%;"></div> <div style="border-bottom: 1px solid black; height: 1.2em; width: 100%;"></div>	
IOC Date: <div style="border-bottom: 1px solid black; width: 20px;"></div> / <div style="border-bottom: 1px solid black; width: 20px;"></div> / <div style="border-bottom: 1px solid black; width: 20px;"></div>	
Date of Last Update: <div style="border-bottom: 1px solid black; width: 20px;"></div> / <div style="border-bottom: 1px solid black; width: 20px;"></div> / <div style="border-bottom: 1px solid black; width: 20px;"></div>	
Does Documentation Exist? (Y/N/U): <div style="border-bottom: 1px solid black; width: 40px;"></div>	
Document Title	Available Collected
	<div style="border-bottom: 1px solid black; width: 20px;"></div> <div style="border-bottom: 1px solid black; width: 20px;"></div>
	<div style="border-bottom: 1px solid black; width: 20px;"></div> <div style="border-bottom: 1px solid black; width: 20px;"></div>
	<div style="border-bottom: 1px solid black; width: 20px;"></div> <div style="border-bottom: 1px solid black; width: 20px;"></div>

AIR FORCE

Description of Resource:

Line 1

Line 2

Line 3

Line 4

Line 5

Special Features of Resource:

Line 1

Line 2

Line 3

Limitations of Resource:

Line 1

Line 2

Line 3

AIR FORCE
COST MODEL/ DATA BASE CATALOG
DATA ENTRY WORKSHEET

Automated (Y,N,U):	<input type="checkbox"/>	Equipment Type:	
Operating System:			
Memory Requirements:			
Programming Language:			

Key Words:			
1. <input type="text"/>	2. <input type="text"/>	3. <input type="text"/>	4. <input type="text"/>
6. <input type="text"/>	7. <input type="text"/>	8. <input type="text"/>	5. <input type="text"/>
			10. <input type="text"/>

APPENDIX B
NON-DoD AND ACADEMIC PARTICIPANTS

CARRS NON-DoD AND ACADEMIC POCs AND ADDRESSES

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National Technical Information Service

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Office of Management and Budget

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The Aerospace Corporation

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The RAND Corporation

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Santa Monica, CA 90406-2138
(213) 393-0411

APPENDIX C
COST ANALYSIS TOOLS

<u>Resource Title</u>	<u>ID Number</u>
A CER for Predicting Quarterly Maintenance Cost of an IMU	1.F.0161
A Comparison of Cost Models for Fighter Aircraft	1.B.0019
A Cost Prediction Model for Electronic Systems Flight Test	1.F.0157
A-7 ALOFT Cost Model	1.N.0066
ADA Software Data Base	2.B.0009
AFCUE (Airlift Fleet Cost-Effectiveness Uncertainty Estim.)	1.G.0001
ALEC (Aggregate Life Cycle Effectiveness and Cost Model)	1.B.0010
AXAF Spacecraft Cost Model Data Base	2.D.0002
Activity Based Cost System	1.G.0003
Advanced Airframe Structural Materials Cost Model	1.B.0015
Advanced Airframe Structural Materials Data Base	2.B.0002
Advanced Space Transportation System Airframe CERS	1.D.0011
Aerospace Spacecraft Cost Model	1.B.0004
Aerospace Weapon System Acquisition Milestones: A Data Base	2.B.0004
Aircraft Airframe Cost Estimating Relationships	1.B.0012
Aircraft System Test and Evaluation Model	1.N.0064
Airframe Cost Estimation Using Error Components Model	1.G.0005
Airframe Data	2.G.0002
Airframe Production Rate Effect on Direct Labor Requirements	1.F.0150
An Examination of Operational Availability in LCC Models	1.F.0152
Annual Unit Recurring O&S Cost Methodology	1.B.0017
Attitude Determination & Control Subsystem CERS - JPL Model	2.D.0003
BARS (Bid Analysis and Reporting System)	1.E.0003
BLCC (Building Life Cycle Cost Program)	1.E.0008
BP&E (Budget Preparation and Execution Module)	1.O.0010
Balance of Sortie (BOS) Costing Techniques	1.D.0009
Balancing Accession & Retention: Cost/Productivity Tradeoffs	1.B.0026
Balancing Accession and Retention: The Aggregate Model	1.B.0029
CAPPS (Contract Appraisal System)	1.A.0033
CASA (Cost Analysis Strategy Assessment College)	1.A.0035
CERS for Imaging and Non-Imaging Payloads	1.D.0005
CERS & Percentage Relationships for Cost Functional Factors	1.D.0012
CERS for Communications & Data Handling for JPL Cost Model	1.D.0006
CERS for Electronic Hardware on Unmanned Spacecraft	1.D.0003
CERS for Graphite Epoxy Structure	1.D.0025
CERS for Imaging Instruments	1.D.0035

<u>Resource Title</u>	<u>ID Number</u>
CERs for Naval Surface Ship Electronic Warfare Equipment	1.N.0074
CERs for Spaceborne Telescopes	1.D.0036
CERs for Structures	1.D.0038
CERs for Unmanned Spacecraft Peripheral Communications H/W	1.D.0004
CERs for Visible, Infrared and Ultraviolet Sensors	1.D.0037
CERs-Command & Data Handling Subsystem-Unmanned Spacecraft	1.D.0030
COSTDEMO (Cost Determination Model for Electronics Training)	1.N.0054
Circuit Card Assembly Cost Data Base	2.B.0006
Circuit Card Assembly Cost Model	1.B.0028
Circuit Card Component Cost Data Base	2.B.0007
Commercial Information Processing H/W CERs & Cost Factors	1.D.0007
Competitive Major Weapon Systems Procurement Cost Analysis	1.N.0068
Cost Estimating Relationships for Fighter Aircraft	1.N.0070
Cost Estimation of Architectural and Engineering Contracts	1.N.0071
Cost Estimation of Ship Acquisition	1.N.0062
Cost Impact from Break in Production Schedule Model	1.D.0028
Cost Model for Estimating Architect-Engineer Fees	1.F.0162
Cost Model for Independent Entry Research Program (IERP)	1.D.0021
Cost Model for Large Space Structures	1.D.0039
Cost Model for Solar Electric Propulsion (SEP)	1.D.0022
Cost Model for the Phase II LFC Glove Flight	1.D.0027
Cost Trend of Follow-on Spacecraft	1.D.0015
Cost/NOA (New Obligation Authority) Schedule Model	1.D.0019
Current Navy RDT&E Vs Future Involvement in Procurement	1.N.0053
Data Handling Cost Model	1.D.0031
Deep Space Network (DSN) Cost Estimation Model	1.D.0034
Defense Price Index Inputs: Durable Goods	2.E.0003
Defense Price Index Inputs: Nondurable Goods	2.E.0002
Defense Price Index Inputs: Services	2.E.0001
Defense Price Index Inputs: Structure	2.E.0004
Developing Software Size Estimating Relationships	1.F.0160
Development & Production CERs for Aircraft Turbine Engines	1.B.0014
Discrete Dynamic Optimization Model for Cost Analysis	1.G.0002
Dual Sourcing and Cost Savings	1.N.0055
Dynamic DOPMS Model Cost Module	1.B.0021
ECER (Enhanced Cost Estimating Relationship Program)	1.E.0005
ESD C3I Software Data	2.B.0008
EVE (Entry Vehicle Experiment) Cost Model	1.D.0018
Econometric Cost Functions for FAA Cost Allocation Model	1.E.0002

<u>Resource Title</u>	<u>ID Number</u>
Engine Production Rate Effects on Direct Labor Requirements	1.F.0059
Enhanced SEEK IGLOO Life Cycle Cost Model	1.F.0126
Estimated Costs of Extended Low-Rate Airframe Production	1.B.0009
Estimating & Controlling the Cost of Extending Technology	1.N.0057
Estimating Aircraft Depot Maintenance Costs	1.B.0008
Estimating USAF Aircraft Recoverable Spares Investment	1.B.0007
Estimating the Cost of Aircraft Structural Modification	1.B.0005
FBLCC (Federal Building Life Cycle Cost Model)	1.E.0010
FORCOST (Force Costing Model)	1.A.0032
FSS (Federal Supply Service) Econometric Model	1.E.0004
FSS (Federal Supply Service) Econometric Model Data Base	2.E.0005
Forecasting Long Term Acquisition Cost Growth Rates of Ships	1.N.0060
Future V/STOL Airplanes: Acquisition Guidelines & Techniques	1.B.0018
GSA Automated Freight Rate & Routing System	2.E.0006
Heavy Lift Launch Vehicle (HLLV) Cost Model	1.D.0008
Heavy Lift Launch Vehicle/Orbital Transfer Vehicle (HLLV/OTV)	1.D.0001
Helicopter Aircraft Systems Costs & Weights Model	1.D.0044
Historical Cost Data Base Management Program	2.E.0007
Holmes & Narver Cost Estimating Program	1.E.0006
Individual Ship Procurement Cost	2.B.0005
Introduction to the USAF Total Force Cost Model	1.B.0023
JPL Project Cost Model	1.D.0041
JPL Software Product Assurance Data Base	2.D.0004
Kanter's Factors	1.F.0151
LWCM (Laser Weapon Cost Model)	1.F.0164
Large Space Power Systems Cost Model	1.B.0003
Large Space Power Systems Cost Model Data Base	2.B.0001
Learning Curve Data	2.N.0027
Life Cycle Cost Model for Satellite Power Systems (SPS)	1.D.0023
Life Cycle Costing: A Working Level Approach	1.F.0156
Life-Cycle Analysis of Aircraft Turbine Engines	1.B.0027
MACO (Model for Estimating Aircraft Cost of Ownership)	1.B.0011
MODCOM	1.B.0022
MSFC Launch Vehicle Cost Model	1.D.0002
Manpower (Tactical Aircraft Maintenance Personnel Model)	1.B.0020
Manpower Training Requirements Model for New Weapon Systems	1.N.0075
Model of Aerospace Contractor Overhead Costs	1.N.0073

<u>Resource Title</u>	<u>ID Number</u>
Model to Evaluate Vendor Bids for Item Stock Replenishment	1.N.0069
Models For Conducting Economic Analysis of Fuel Vehicles	1.N.0063
Models for Electronic Warfare Equipment Flight Tests	1.F.0153
NAVMAN	1.B.0016
NBSLCC (National Bureau of Standards Life Cycle Cost Model)	1.E.0009
Operating and Support Cost Estimating, A Primer	1.F.0163
Out of Production Cost Factor	1.F.0155
P-3 Survivability and Crew Cost Considerations	1.N.0065
PACE (Parametric Cost Estimating Model)	1.A.0034
PRATE (An Automated Airframe Production Cost Model)	1.G.0004
PSM (Procurement Strategy Module)	1.O.0015
Parametric Estimating Model for Flight Simulator Acquisition	1.F.0158
Parametric Tool for Estimating Simulator Software Sizing	1.F.0159
Planetary Spacecraft CERS	1.D.0010
Procedures for Estimating LCC of Electronic Combat Equipment	1.B.0013
Program Costs For a System Force	1.B.0002
Protoflight Unmanned Spacecraft Cost Model CERS	1.D.0020
Prototype Unmanned Spacecraft Cost Model	1.D.0040
Quick Cost Module	1.A.0036
RASCOM (Radiometer Subsystem Cost Model)	1.D.0017
REDSTAR (Resource Data Storage and Retrieval System)	2.D.0001
Reformulation of Cumulative Average Learning Curve	2.N.0026
Regression Model for Predicting Navy Billet Authorizations	1.N.0056
Regression Models of Quarterly Indirect Labor Hours for NARF	1.N.0058
Resource Dynamics Ship and Aircraft Asset Values	2.G.0001
Retirement Simulation and Costing System (RSCS)	1.E.0001
SARA (Schedule and Resource Allocation Model)	1.O.0014
SATCOST	1.B.0001
SCRAM (Schedule Risk Assessment Management Model)	1.O.0012
SECM (Support Equipment Cost Model)	1.D.0016
SWCE (Software Cost Estimating Module)	1.O.0011
Scientific Instrument Cost Model (SICM)	1.D.0013
Simple Relationships for Estimating US Navy Ship Procurement	1.B.0024
Space Processing Applications Cost Model	1.D.0014
Space Station Cost Model	1.D.0024
Space Telescope Spectrograph, Photometer & TV Camera CERS	1.D.0026
Space Telescope Support Systems Module Cost Data	2.D.0005

<u>Resource Title</u>	<u>ID Number</u>
Statistical Modeling of Quarterly Contractor Overhead Costs	1.N.0061
Statistical Models for Estimating Overhead Costs	1.N.0072
Study of Cost Estimating of R&D Programs	2.D.0006
Study of Short-Haul Aircraft Operating Economics	1.D.0043
Summary of Navy Enlisted Supply Study	1.B.0025
System Integration Management (SIM) Model	1.D.0033
Systems Cost/Performance Model	1.D.0029
TAPS (The Automated Prospectus System)	1.E.0007
The DPAC Compensation Model: An Introductory Handbook	1.F.0149
The Dynamic Retention Model	1.B.0006
The FFG-7 Frigate-Application of Design-to-Cost Concept	1.N.0067
The Rand Airframe Data Base	2.B.0003
The Sentinel Bright Cost Models Program	1.F.0148
Time Estimating Relationships (TERs) for Unmanned Spacecraft	1.D.0032
Translation of the LCC-2 Life Cycle Cost Model	1.F.0154
Transport Aircraft Systems Cost & Weight Model	1.D.0042
US Naval Ship Cost Growth	1.N.0059
VERT (Venture Evaluation Review Techniques Module)	1.O.0013

APPENDIX D
REVISED LIST OF CONSISTENCY CHECKS

CHECKLIST FOR CONSISTENCY

Resource Type:

- If a model includes a data base, create a record for each, and cross-reference them by I.D. Numbers in the Special Features field.

Resource Name:

- Put any acronyms of models and data bases first, followed by full title in parentheses.

Example: IRLA (Item Repair Level Analysis)

Controlling Activity:

- Spell out acronyms of DoD organizations, if possible. Begin with the acronym, if one exists, and follow with the complete spelling in parentheses.

Example: ASD/ACCI (Aeronautical Systems Division)

- See list of Controlling Activities and their addresses included in this appendix.
- If the Controlling Activity is not a DoD organization, spell out the name of the company first, then follow with the acronym in parentheses.

Point of Contact:

- For POC Title, use rank abbreviation, Mr., Ms., Dr., (if known) and first name. Use first initial if first name is too long or unknown.
- Use "Unknown" if the name of the POC is not available. Insert this in the POC Title field, not in the POC Last Name field.
- If the POC is unknown or the POC listed was obtained from outdated information, then the limitations section should read, "Current POC unknown."
- If the POC listed is a librarian contacted for information, the limitations section should read, for example, "POC listed is ESD Cost Librarian."

- See the list of POC names and addresses included in this appendix.

Document Title:

- If the documentation title takes up more than one line, continue onto the next line, indenting one space.
- Use the following abbreviation for a particular volume of documentation: Vol. I, Vol. II, etc.

POC Phone Number:

- Begin with the area code or autovon abbreviation in parentheses, followed by the number.
- Use an Autovon number, if available.

Example: (AV) 227-0317
(202) 433-4084

POC Address:

- Use "Unknown" if the address is not available.
- Pentagon Zip Codes:
 - 20301 - Department of Defense
 - 20310 - Army
 - 20330 - Air Force
 - 20350 - Navy
- Use "DC" instead of "D.C."
- Use "HQ" for headquarters.
- See POC address list, included in this appendix, for more information.
- If the address is only 2 lines, use the first two lines, leaving the third line blank.

Call Number:

- Enter the library name acronym (e.g., ASD, SD, AD, DTIC, DLSIE), a space, and then the catalog number.
- If there is a document number in addition to a Call Number, list the document number in the Document Title field if space allows.

Resource Developer:

- For Government organizations, list the acronym first followed by the full spelling in parentheses.
- For private companies, list the full spelling of the company name first followed by any company abbreviation in parentheses.
- If there is more than one developer, separate them by a semicolon (;).
- If a resource is a thesis or dissertation, list the author first, than a slash (/), followed by the name of the educational institution.

Date:

- Leave date blank if unknown. "N/A" is the default and will show up in the reports.
- IOC Date must be less than Date of Last Update.
- If month or day is unknown, insert zeros.

Description, Special Features or Limitations:

- Single space between sentences & after colons.
- Use "&" instead of "and" if necessary to fit in text.
- Make sentences shorter by eliminating unnecessary articles, prepositions, verbs, etc... if more room is needed.
- For important phrases that someone would be likely to search on, try to include both the full spelling and the common abbreviation in the text.

Example: Life Cycle Costs (LCC).

- For abbreviations or acronyms that cannot be spelled out in the text, add a definition to the acronym lists.
- Do not insert periods in abbreviations such as Washington, DC and US.
- Capitalize names of other cost models or data bases.

- Refer to a particular fiscal year as follows:
FY75, FY81, etc.

Description:

- Use "Unknown." if no description is available.

Special Features:

- Use "Unknown." if no special features are known.

Limitations:

- Make sure SECRET, CONFIDENTIAL and For Official Use Only documents are noted in the limitations section.
- If resource availability is unknown, then it should say so in the limitations.

Example: "Model availability unknown."
- If documentation was found in a cost library, limitations should read "Information obtained from documentation reviewed at..."
- If POC listed is a librarian, limitations should include statement "POC listed is ESD Cost Librarian."
- If POC listed is unknown or outdated, limitations should include statement "Current POC unknown."
- Use "Unknown." if information on limitations is not available.

Automation:

- Use "Unknown" if resource automation is not known.
- See automation consistency list in this appendix for more information.
- If resource is not automated, do not enter anything in the next four fields since they do not appear on the report.
- Use "Unknown" if information on Equipment, Operating System, Memory, or Language is not available.

For Consistency:

- "Life Cycle Cost" not Life-Cycle cost.
- No periods in US.
- Trade-off has a hyphen.
- User's has an apostrophe.
- Etc... is spelled "etc."
- "CERs" not CER's.
- RCA PRICE is capitalized.
- Use periods in P.O. Box.
- Capitalize POC - do not use periods.

Rank Abbreviations:

- | | | |
|---|--------|----------------------|
| ● | Lt | Lieutenant |
| ● | Ens | Ensign |
| ● | Capt | Captain |
| ● | Maj | Major |
| ● | Lt Col | Lieutenant Colonel |
| ● | Col | Colonel |
| ● | LCDR | Lieutenant Commander |
| ● | CDR | Commander |

CONTROLLING ACTIVITY ADDRESSES

1. ACSC (Air Command and Staff College)
Air Command and Staff College/EDCC
Air University
Maxwell Air Force Base, AL 36112
2. AD (Armament Division)
Department of the Air Force
Armament Division/{subdiv code}
Eglin Air Force Base, Florida 32542-5260
3. AF/ACCC (US Air Force Cost Programs Division)
HQ USAF/ACCC
The Pentagon, Room 4D184
Washington, D.C. 20330
4. AF/RDQ (Direct. of Operational Requirements)
Department of the Air Force
AF/RDQ, The Pentagon
Washington, D.C. 20330
5. AFALC (AF Acquisition Logistics Center)
Department of the Air Force
AFALC/{subdiv code}
Wright-Patterson AFB, Ohio 45433-6503
6. AFCAC/AV (Air Force Computer Acquisition Center)
AFCAC/AV
Hanscom Air Force Base
Hanscom, Massachusetts 01731-5000
7. AFCMD/SA (Air Force Contract Management Division)
Department of the Air Force
AFCMD/SA
Kirtland Air Force Base, New Mexico 87117-5000

8. AFESC/DEC (Engineering & Services Center)
Department of the Air Force
HQ AFESC/DEC, Stop 21
Tyndall Air Force Base, Florida 32403-6001
9. AFHRL (AF Human Resources Laboratory)
Department of the Air Force
AFHRL/{subdiv code}
Wright-Patterson AFB, Ohio 45433-6503
10. AFIT (Air Force Institute of Technology)
Air Force Institute of Technology
School of Systems and Logistics
Wright-Patterson AFB, OH 45433-5000
11. AFLC (Air Force Logistics Command)
Department of the Air Force
HQ AFLC/{subdiv code}
Wright-Patterson AFB, Ohio 45433-6503
12. AFSC/ACC (Air Force Systems Command)
HQ AFSC/ACC
Andrews Air Force Base
Washington, D.C. 20334-5000
13. AFWAL/AA... (Avionics Laboratory)
Department of the Air Force
AFWAL/{subdiv code}
Wright-Patterson AFB, Ohio 45433-6503
14. AFWAL/FI... (Flight Dynamics Laboratory)
Department of the Air Force
AFWAL/{subdiv code}
Wright-Patterson AFB, Ohio 45433-6503
15. AFWL (Air Force Weapons Laboratory)
Department of the Air Force
Air Force Weapons Laboratory
Kirtland Air Force Base, New Mexico 87117-5000

16. AGMC (Aerospace Guidance & Metrology Center)
Aerospace Guidance & Metrology Center
Newark Air Force Station, Plans & Program Office
Newark, Ohio 43057
JSDE/IS (Joint Services Data Exchange Group)
Aerospace Guidance & Metrology Center
Plans and Program Office
Newark Air Force Station, Ohio 43055
17. AMRAAM Joint System Program Office
AMRAAM Joint System Program Office
Armament Division
Eglin Air Force Base, Florida 32542-5260
18. ASA (RDA) (Assistant Secretary of the Army)
Deputy for Management and Budget, ASA (RDA)
The Pentagon, Room 2E673
Washington, D.C. 20301
19. ASD (Aeronautical Systems Division)
Department of the Air Force
ASD/{subdiv code}
Wright-Patterson AFB, Ohio 45433-6503
20. AVSCOM (U.S. Army Aviation Systems Command)
USAAVSCOM, Cost Analysis Division
P.O. Box 209 (Estimates & Studies Branch)
St. Louis, Missouri 63166

USAAVSCOM, Directorate for Plans & Analysis
4300 Goodfellow Blvd. (Data Analysis & Control)
St. Louis, Missouri 63120

USAAVSCOM/DRDAV-BA
4300 Goodfellow Blvd.
St. Louis, Missouri 63120
21. BEA (Bureau of Economic Analysis/Commerce)
Bureau of Economic Analysis
US Dept of Commerce, PMB, BE-57
Washington, DC 20230-0001

22. BMO (Ballistic Missile Office)
Department of the Air Force
HQ Ballistic Missile Office/(subdiv code)
Norton Air Force Base, California 92409-6468
23. CBO (Congressional Budget Office/NSD)
CBO/NSD, House Office Bldg., Annex #2
Second and D Streets, S.W.
Washington, DC 20515
24. CEAC (Cost & Economic Analysis Center)
USACEAC (Attn: CACC-VE)
1900 Half Street, S.W.
Washington, D.C. 20324-2300

USACEAC
1900 Half Street, S.W.
Room 7331
Washington, D.C. 20324-2300
25. CECOM (Communications-Electronics Command)
U.S. Army Communications-Electronics Command
Ft. Monmouth, New Jersey 07703-5000
26. Center for Naval Analyses, Systems Evaluation Group
Center for Naval Analyses
2000 North Beauregard Street
Alexandria, Virginia 22311
27. Computer Economics, Inc. (CEI)
Computer Economics, Inc.
4560 Admiralty Way, Suite 109
Marina Del Ray, California 90292
28. DCA (Defense Communications Agency)
Defense Communications Agency
Cost and Program Analysis Branch, Code H610
Washington, D.C. 20305-2000

29. DCEC (Defense Communications Engineering Center)

Defense Communications Engineering Center
1860 Wiehle Ave., Drey Engineering Bldg.
Reston, Virginia 22090

30. DLA (Defense Logistics Agency)

Defense Logistics Agency
Boston, Massachusetts 02210-2184

31. DOE (Department of Energy)

Dept. of Energy, Forrestal Bldg., Room 5A014
1000 Independence Ave., S.W.
Washington, DC 20585

32. DSMC (Defense Systems Management College)

Defense Systems Management College
Director, PMSS Directorate
Ft. Belvoir, VA 22060-5426

33. Decision-Science Applications, Inc.

Decision-Science Applications, Inc.
1901 North Moore Street, Suite 1000
Arlington, VA 20009

34. Directorate of Operational Requirements

Directorate of Operational Requirements
Deputy Chief of Staff
Research, Development & Acquisition
Wright-Patterson AFB, Ohio 45433-6503

35. EDDINS-EARLES

EDDINS-EARLES
89 Lee Drive
Concord, Massachusetts 01742

36. ESD (Electronic Systems Division)

HQ ESD/(subdiv code)
Hanscom Air Force Base
Hanscom, Massachusetts 01731-5000

HQ ESD
Computer Systems Engineering Directorate (TOI)
Hanscom Air Force Base
Hanscom, Massachusetts 01731-5000

ESD/SC5-3 (SACDIN Program Office)
Hanscom Air Force Base
Hanscom, Massachusetts 01731-5000

HQ ESD
SEEK TALK System Program Office
Hanscom Air Force Base
Hanscom, Massachusetts 01731-5000

ESD/XRSE (Software Design Center)
Deputy for Development Plans & Support Systems
Hanscom Air Force Base
Hanscom, Massachusetts 01731-5000

37. FAA (Federal Aviation Administration)

Office of Aviation Policy and Plans
FAA, Department of Transportation
Washington, DC 20591

38. GSA (General Services Administration)

General Services Administration
1941 Jefferson Davis Highway, Room 520
Arlington, VA 22202

39. George Washington University

George Washington University
Department of Operations Research, SEAS
Washington, DC 20052

40. Harvard University

Harvard University, Soldiers Field
Graduate School of Business Administration
Boston, MA 02163

41. WANG Institute of Graduate Studies (WICOMO Model)

WANG Institute of Graduate Studies
School of Information Technology
Tyngsboro, Massachusetts 01879

42. IDA (Institute for Defense Analysis)
Institute for Defense Analysis
1801 North Beauregard Street
Alexandria, VA 22311
43. JTCO (Joint Tactical Communications Office)
Department of the Army
Joint Tactical Communications Office
Ft. Monmouth, New Jersey 07703-5000

Joint Tactical Communications Office
Operational Research Division
Ft. Monmouth, New Jersey 07703-5000
44. MCDEC (Marine Corps Development and Educational Command)
Marine Corps Development and Educational Command
DL/S Plans, Development Center
Quantico Marine Corps Base, Virginia 22134
45. NADC (Naval Air Development Center)
Naval Air Development Center
Systems Directorate Cost Analysis Group
Warminster, Pennsylvania 18374
46. NAMO-24 (Naval Air Maintenance Organization)
Naval Air Maintenance Organization (NAMO-24)
Patuxent River Naval Annex
Patuxent, Maryland 20670-5449
47. NASA (National Aeronautics and Space Administration)
ARC (Ames Research Center)
Ames Research Center - NASA
Moffett Field, CA 94035

GSFC-NASA (Goddard Space Flight Center)
George C. Marshall Space Flight Center - NASA
Engineering Cost Group
Huntsville, AL 35812

JPL-NASA (Jet Propulsion Laboratory)
JPL/California Institute of Technology
4800 Oak Grove Drive, MAIL STOP 180-402
Pasadena, CA 91109

LRC-NASA (Langley Research Center)
George C. Marshall Space Flight Center - NASA
Engineering Cost Group
Huntsville, AL 35812

MSFC-NASA (Marshall Space Flight Center)
George C. Marshall Space Flight Center - NASA
Engineering Cost Group
Huntsville, AL 35812

OART-NASA (Advanced Concepts & Missions Div)
Moffet Field, CA 94035

OMSF-NASA (Office of Manned Space Flight)
NASA
Office of Manned Space Flight, Code M
Washington, DC 20546

48. NAVAIR (Naval Air Systems Command)

Naval Air Systems Command {subdiv code}
1421 Jefferson Davis Highway
Jefferson Plaza No. 2
Arlington, Virginia 20361

49. NAVSEA (Naval Sea Systems Command)

Department of the Navy
Naval Sea Systems Command, {subdiv name}
Washington, D.C. 20362-5101

50. NAVWESA (Naval Weapons Engineering Support Activity)

Naval Weapons Engineering Support Activity
Washington Navy Yard, Building 220
Washington, DC 20003

51. NBS (National Bureau of Standards)

National Bureau of Standards
Administration Building, Room 415
Gaithersburg, MD 20899

52. NCA (Naval Center for Cost Analysis)

Naval Center for Cost Analysis
The Pentagon, Room 4A522
Washington, D.C. 20350-1100

53. NMC (Naval Missile Center)
Naval Missile Center
Point Mugu, California 93042
54. NPGS (Naval Postgraduate School)
Naval Postgraduate School
Department of Administrative Sciences
Monterey, CA 93943-5000
55. NPRDC (Navy Personnel R&D Center)
Department of the Navy
Navy Personnel Research and Development Center
San Diego, California 92152
56. NSWC (Naval Surface Weapons Center)
Department of the Navy
Naval Surface Weapons Center
Dahlgren, Virginia 22448

Naval Surface Weapons Center
White Oak Laboratory
Silver Spring, Maryland 20903-5000
57. National Defense University
War Gaming and Simulation Center
National Defense University
Washington, DC 20319-6000
58. Naval Weapons Center
Naval Weapons Center
Weapon Systems Cost Analysis Division
China Lake, California 93555-6001
59. OSD (Office of the Secretary of Defense)
OSD (MRA&L-(subdiv code))
The Pentagon, Room 2B269
Washington, D.C. 20301

OSD, Director of Net Assessment
The Pentagon, Room 3A930

Washington, D.C. 20301
OSD/PA&E
The Pentagon, Room 2D278
Washington, D.C. 20301-1800

60. OUSD (A)

Office of the Under Secretary of Defense/Acquisition
The Pentagon, Room 3E1031
Washington, D.C. 20301

61. Office of the Chief of Naval Research

Office of the Chief of Naval Research
800 North Quincy Street
Ballston Center Tower No. 1
Arlington, Virginia 22203

62. U.S. Army, Office of the Chief of Engineers

U.S. Army, Office of the Chief of Engineers
20 Massachusetts Avenue, N.W.
Room 2229
Washington, D.C. 20001

63. Quantitative Software Management, Inc. (QSM)

Quantitative Software Management, Inc.
1057 Waverley Way
McLean, Virginia 22102

64. RADC (Rome Air Development Center)

Department of the Air Force
RADC/{subdiv code}
Griffiss Air Force Base, New York 13441

65. Reifer Consultants, Inc.

Reifer Consultants, Inc.
25550 Hawthorne Blvd.
Suite 208
Torrance, California 90505

66. SD (Space Division)
HQ Space Division/{subdiv code}
P.O. Box 92960
Los Angeles, California 90009-2460
67. Jamieson Science & Engineering, Inc.
7315 Wisconsin Avenue
Suite 477W
Bethesda, Maryland 20814
68. SDIO System Engineering Office

SDIO, System Engineering S/SE
The Pentagon
Washington, DC 20301-7100
69. SPAWAR (Space and Naval Warfare Systems Command)

Space and Naval Warfare Systems Command
SPAWAR 10J
2511 Jefferson Davis Highway (NC-1)
Washington, D.C. 20363-5100
70. Software Productivity Research, Inc.

Software Productivity Research, Inc.
2067 Massachusetts Ave.
Cambridge, Massachusetts 02140
71. TACOM (U.S. Army Tank-Automotive Command)

U.S. Army Tank Automotive Command
ATTN: AMSTA-VC
Warren, Michigan 48397-5000
72. TRADOC (US Army Training and Doctrine Command)

HQ USATRADOC
Director of Combat Developments
Cost Analysis Division
Ft. Monroe, Virginia 23651
73. The Aerospace Corporation

The Aerospace Corporation
Resource Analysis Directorate
P.O. Box 92957
Los Angeles, CA 90009

74. The MITRE Corporation
Economic Analysis Center
7525 Coleshire Drive
McLean, VA 22102

The MITRE Corporation
Burlington Road, MAIL STOP G102
Bedford, VA 01730
75. The Rand Corporation

The Rand Corporation
1700 Main Street, P.O. Box 2138
Santa Monica, California 90406-2138
76. U.S. Army Missile Command

U.S. Army Missile Command
Plans and Analysis Director
Cost Analysis Division
Redstone Arsenal, Alabama 35898-5000
77. U.S. Army Weapons Command

U.S. Army Weapons Command, {subdiv name}
Rock Island Arsenal
Rock Island, Illinois 61299-6000
78. USAMC (US Army Materiel Command)

Department of the Army, HQ AMCSM/PIR
5001 Eisenhower Avenue
Alexandria, Virginia 22333
79. USAMC (US Army Materiel Command)

USAMC/MRSA
AMXMD-EL
Lexington, Kentucky 40511-5101
80. University of Alabama

University of Alabama, P.O. Box 6316
Department of Industrial Engineering
University, AL 35486

81. University of Cincinnati

University of Cincinnati
Dept. of Quantitative Analysis & Information Systems
Cincinnati, OH 45221

82. University of Mississippi

University of Mississippi
Economics and Finance Department
University, MS 38677

83. Commandant of the Marine Corps

Commandant of the Marine Corps
Code LMA-1
Washington, D.C. 20380

84. WRALC (Warner Robins Air Logistics Center)

Department of the Air Force
WRALC/{subdiv code}
Robins Air Force Base, Georgia 31098

AUTOMATION CONSISTENCY LIST

Equipment

Apple Macintosh
VAX **** (e.g., VAX 8600, VAX 11/780, VAX 780)
AFLC CREATE
GE Timeshare System
CDC 170 Model 730
CDC **** (e.g., CDC 3600, CDC 6600)
CREATE
Digital
Honeywell **** (e.g., Honeywell 6000, Honeywell 6680)
HP **** (e.g., HP 1000, HP 3000, HP 9830)
IBM *** (e.g., IBM 360, IBM 360/65)
IBM PC XT/AT/Compatible
IBM PC/Compatible
NAS **** (e.g., NAS 9160)
On-line System (OLS)
PRIME 750
TI-59 programmable calculator
Tektronix **** (e.g., Tektronix 4054, Tektronix 4051)
UNIVAC **** (e.g., UNIVAC 1100, UNIVAC 1100/83)
WANG
Zenith Z-*** (e.g., Zenith Z-100, Zenith Z-248)

Memory

***K RAM (e.g., 128K RAM, 256K RAM, 640K RAM)
DSDD floppy drives
*** MB disk storage (e.g., 500 MB disk storage)

Language

ASCII file
Assembly
BASIC
C Language
COBOL
CONDOR DBMS
dBase II
dBase III
DCL
EQUEL FORTRAN
EXCEL
FOCUS
FORTRAN
FORTRAN 77
FORTRAN IV
FOXBASE
INFO DBMS
INGRES RDMS

Lotus 1-2-3
Microsoft
MODLER
MULTICS
ORACLE
Pascal
PL/1
R:Base System V
SAS
SPSS
Symphony
VAX COBOL
VAX FMS
VS APL
ZBASIC

Operating System

DOS
DOS 2.0 or greater
MS-DOS
PC-DOS
Z-DOS
NOS 2.2 Level 602
PRIMOS
TSO
VMS
APEX IV
CMS
CP/M
UNIX

APPENDIX E

REVISED ACRONYM AND KEY WORD LISTS

ACRONYMS

A

AD	Armament Division
ACAP	Army Advanced Composite Airframe Program
ACOL	Annualized Cost of Leaving
ACWP	Actual Cost of Work Performed
ADP	Automated Data Processing
AF	Air Force
AFA	Automated Financial Analysis
AFLC	Air Force Logistics Command
AFR	Air Force Regulation
AF/RDQ	Air Force Directorate of Operational Requirements
ALC	Air Logistics Center
ALOFT	Airborne Light Optical Fiber Technology
AMPR	Aeronautical Manufacturers Planning Report
ANG	Air National Guard
AP	Aircraft Procurement
ASD	Aeronautical Systems Division
AVFUEL	Aviation Fuel
A&E	Architectural and Engineering

B

BAC	Budget at Completion
BACE	Budget Analysis Cost Estimating
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BEA	Bureau of Economic Analysis
BMDO	Ballistic Missile Defense Office
BMI	Bismaleimide
BPI	Bits Per Inch

C

CACE	Cost Analysis Cost Estimating
CAIG	Cost Analysis Improvement Group
CBS	Cost Breakdown Structure
CCB	Configuration Control Board
CCDR	Contractor Cost Data Reporting
CCMAS	Construction Cost Management Analysis System
CER	Cost Estimating Relationship
CIR	Cost Information Report
CIRF	Contractor's Intermediate Repair Facility
CLIN	Contract Line Item Number
CLS	Contractor Logistics Support
CNO	Chief of Naval Operations
COCOMO	Constructive Cost Model
COO	Cost of Ownership
CPR	Cost Performance Report

CSCI	Computer Software Cost Item
CSI	Construction Standards Index
CU	Capacity Utilization
C/SSR	Cost/Schedule Status Report

D

DA	Department of the Army
DACS	Data and Analysis Center for Software
DBMS	Data Base Management System
DCA	Defense Communications Agency
DCS	Defense Communications Systems
DDN	Defense Data Network
DDT&E	Design, Development, Test and Evaluation
DEC	Engineering Cost Management
DLSIE	Defense Logistics Studies Information Exchange
DMS	Defense Materiel Systems
DOD	Department of Defense
DRU	Depot Repairable Units
DSARC	Defense System Acquisition Review Council
DSN	Defense Switched Network
DSN	Deep Space Network
DTIC	Defense Technical Information Center
DT/OT	Development Test/Operational Test
DTLCC	Design to Life Cycle Cost
D&D	Design & Development
D&V	Design and Validation

E

EAC	Estimate at Completion
EC	Electronic Combat
ECM	Electronic Countermeasures
ECP	Engineering Change Proposal
ED	Engineering Development
E&D	Engineering & Design
ERADCOM	US Army Electronics Research & Development Command
ESD	Electronic Systems Division
EW	Electronic Warfare

F

F.A.I.T.	Fabrication Assembly Integration and Test
FH	Flight Hardware
FLIR	Forward-Looking Infrared
FSD	Full Scale Development
FSS	Federal Supply Service
FPA	Focal Plane Array
FU	Flight Unit
FYDP	Five-Year Defense Plan

G

G&A	General and Administrative
G&C	Guidance and Control
GFE	Government Furnished Equipment
GPS	Global Positioning System
GSE	Ground Support Equipment

H

HLLV	Heavy Lift Launch Vehicle
HOL	High Order Language
HP	Hewlett Packard
HQ	Headquarters

I

I&A	Integration & Assembly
ICA	Independent Cost Analysis
ICBM	Inter-Continental Ballistic Missile
ICE	Independent Cost Estimate
IIOC	Interim Initial Operational Capability
ILS	Integrated Logistics Support
IMU	Inertial Measurement Unit
IR	Infrared

L

LCC	Life Cycle Cost
LFC	Laminar Flow Control
LOC	Lines of Code
LOS	Line-of-Sight
LRE	Latest Revised Estimate
LRU	Line Replaceable Unit
LSC	Logistics Support Costs
LSS	Large Space Structures

M

MDS	Mission Design Series
MER	Manpower Estimating Relationship
MIA	Missing In Action
MIL-STD	Military Standard
MMH/FH	Maintenance Manhour per Flying Hour
MPA	Military Personnel, Army; Military Pay and Allowances
MPN	Manpower Procurement, Navy
MQT	Model Qualification Test
MR	Management Reserve; Modification Request

MTBD	Mean Time Between Demand
MTBF	Mean Time Between Failure
MTBMA	Mean Time Between Maintenance Actions
MTBR	Mean Time Between Removal
MTS	Monthly Treasury Statement

N

NARF	Naval Air Rework Facility
NAVFAC	Naval Facilities Engineering Command
NAVMAT	Naval Materiel Command
NAVSEA	Naval Sea Systems Command
NAVWESA	Naval Weapons Engineering Support Activity
NC	Numerical Control (computer controlled machines)
NGT	Next Generation Trainer
NRTS	Not Repairable This Station
NTIS	National Technical Information Service

O

O&S	Operating and Support
OH	Overhead
OMA	Operation and Maintenance, Army
OMB	Office of Management and Budget
OMN	Operation and Maintenance, Navy
OOPFAC	Out of Production Factor
OPEVAL	Operational Evaluation
OPN	Other Procurement, Navy
OSD	Office of the Secretary of Defense
OTV	Orbital Transfer Vehicle

P

PDC	Programming, Design, Construction
PEP	Producibility Engineering & Planning
PGSM	Precision-Guided Submunitions
PIP	Product Improvement Program
PME	Prime Mission Equipment
PMRT	Program Management Responsibility Transfer
POC	Point of Contact
POM	Program Objective Memorandum
PSE	Peculiar Support Equipment

Q

Q/A	Quality/Assurance
QC	Quality Control
QTO	Quantity Take-Off

R

R&D	Research and Development
R&M	Reliability & Maintainability
RDT&E	Research, Development, Test and Evaluation
RDT&EN	Research, Development, Test and Evaluation, Navy
RF	Radio Frequency
RIW	Reliability Improvement Warranty
RLA	Repair Level Analysis
RPV	Remotely Piloted Vehicle
RV	Re-entry Vehicle

S

SAR	Selected Acquisition Report
SCCR	Supplemental Contractor Cost Report
SD	Space Division
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Office
SE/PM	Systems Engineering/Program Management
SHIPALTS	Ship Alterations
SIP	Standard Initial Provisioning
SIRCS	Ship Intermediate Range Combat System
S/PM	System/Project Management
SPS	Satellite Power Station
SRU	Shop Replaceable Unit
SSD	Space and Strategic Defense
SSM	Support Systems Module
ST/STE	Special Testing/Special Test Equipment
STE	Special Test Equipment
ST&E	Special Test & Evaluation
STS	Space Transportation System
SWBS	Ship Work Breakdown Structure

T

TCTO	Time Compliance Technical Order
TDME	Test, Measurement & Diagnostic Equipment
TECEP	Training Effectiveness, Cost Effectiveness Prediction
TER	Time Estimating Relationship
TFU	Theoretical First Unit

U

UE	Unit Equipment
UICP	Uniform Inventory Control Program
UPC	Unit Production Cost

V

VAMOSC	Visibility and Management of Operating and Support Costs
VMAX	Maximum Velocity

W

WBS	Work Breakdown Structure
WER	Weight Estimating Relationship
WPN	Weapons Procurement, Navy

KEY WORD LIST BY FUNCTIONAL CATEGORY

A. Purpose/Objective

Acquisition Strategy
Competition Analysis
Cost Estimates/Analyses
Cost/Benefit Analysis
Data Base
Decision Support Systems
Economic Analysis
Financial Analysis
Manpower Estimates/Analyses
Performance Assessments
Planning/Programming/Budgeting
Program Analysis
Requirements Estimates/Analyses
Risk Analysis
Schedule Estimates/Analyses
Software Sizing

B. Costs Covered

Construction Costs
Fixed Costs
Indirect Costs
LCC
Lease Costs
Modification Costs
O&S Costs
Production Costs
R&D Costs

C. Type of Data

Cost Data
Equipment Hour Data
Labor Hour Data
Manpower Data
Program Data
Schedule Data
Technical Characteristics Data

D. Analysis Techniques

Analog Techniques
Contract Analysis
Contractor Data Analysis
Curve Fitting
Econometric Forecasting
Engineering Buildup Techniques
Monte Carlo Simulation
Parametric Techniques
SAR Analysis
Statistical Analysis

E. Relationships

CERs
Cost Factors
Escalation/Inflation Factors & Indices
Learning Curves
Manpower Estimating Relationships (MERs)
Planning Factors
Schedule Estimating Relationships (SERs)
Weight Estimating Relationships (WERs)

F. Cost/Work Breakdown Structure

Cost of Money (COM)
Engineering
Engineering Change Orders (ECO)
Facilities
First Destination Transportation Costs
Flyaway
Forces
Functional Cost Breakdown
Government Furnished Equipment (GFE)
Installation
Integrated Logistic Support (ILS)
Integration & Assembly
Labor/Materials Breakdown
Maintenance
Management Reserve
Manufacturing
Markup
Nonrecurring/Recurring Breakdown
Overhead
Peculiar Support Equipment (PSE)
Personnel
Prime Mission Equipment (PME)
Procurement Support
Profit
Prototype
Site Activation

Spares
System Level Breakdown
Test & Evaluation
Tooling & Test Equipment
Training
Warranty Costs
WBS

G. Equipment Covered

Ada
Aircraft
Airframes
Armament
Artificial Intelligence/Expert System
Avionics
C3I
Command & Control Systems
Communications
Composites
Computer
Electro-Optical
Electronic Warfare
Electronics
Engines
Helicopter
Laser
Launch Vehicles
Missiles
Modifications
Munitions
Navigation
Precision-Guided Submunitions
Radar
RPV
Sensor
Ships
Software
Software (Embedded)
Sonar
Space Systems
Spacecraft
Strategic Defense
Support Equipment
Vehicles (Tracked)
Vehicles (Wheeled)
Weapon Systems

Authority File by Key Word
Entire File

Key Phrase	Key Code
Acquisition Strategy	128
Ada	129
Aircraft	2
Airframes	5
Analog Techniques	6
Armament	7
Artificial Intelligence/Expert Systems	141
Avionics	8
C3I	130
CERs	18
Command & Control Systems	10
Communications	11
Competition	131
Composites	95
Computer	1
Construction Costs	13
Contract Analysis	14
Contractor Data Analysis	9
Cost Data	16
Cost Estimates/Analyses	17
Cost Factors	19
Cost/Benefit Analysis	78
Curve Fitting	110
Data Base	21
Econometric Forecasting	24
Economic Analysis	25
Electro-optical	96
Electronic Warfare	97
Electronics	26
Engineering	27
Engineering Build-up Techniques	28
Engineering Change Orders (ECO)	89
Engines	3
Equipment Hour Data	29
Escalation/Inflation Factors & Indices	30
Facilities	31
Financial Analysis	32
First Destination Transportation Costs	117
Flyaway	33
Forces	85
Functional Cost Breakdown	91
Government Furnished Equipment (GFE)	122
Helicopter	127
Indirect Costs	83
Installation	35
Integrated Logistic Support (ILS)	34

Authority File by Key Word
Entire File

Key Phrase	Key Code
Integration & Assembly	145
Labor Hour Data	36
Labor/Materials Breakdown	90
Laser	100
Launch Vehicles	142
LCC	37
Learning Curves	84
Lease Costs	119
Maintenance	114
Management Reserve	38
Manpower Data	108
Manpower Estimates/Analyses	39
Manpower Estimating Relationships (MERs)	40
Manufacturing	41
Missiles	42
Modification Costs	44
Modifications	4
Monte Carlo Simulation	45
Munitions	46
Navigation	101
Nonrecurring/Recurring Breakdown	47
O&S Costs	48
Overhead	49
Parametric Techniques	50
Performance Assessments	52
Personnel	134
Planning Factors	53
Planning/Programming/Budgeting	80
Precision-Guided Submunitions	54
Prime Mission Equipment (PME)	55
Procurement Support	87
Production Costs	56
Profit	58
Program Data	59
Prototype	135
R&D Costs	22
Radar	103
Requirements Estimates/Analyses	82
Risk Analysis	60
RPV	109
SAR Analysis	61
Schedule Data	62
Schedule Estimates/Analyses	63
Schedule Estimating Relationships (SERs)	64
Sensor	104
Ships	112

Authority File by Key Word
Entire File

Key Phrase	Key Code
Site Activation	65
Software	66
Software (Embedded)	67
Software Sizing	68
Sonar	115
Space Systems	105
Spacecraft	106
Spares	70
Statistical Analysis	71
Strategic Defense	72
Support Equipment	51
System Level Breakdown	146
Technical Characteristics Data	73
Test & Evaluation	88
Tooling & Test Equipment	74
Training	138
Vehicles (Tracked)	75
Vehicles (Wheeled)	77
Warranty Costs	111
WBS	139
Weapon Systems	86
Weight Estimating Relationships (WERs)	76

KEY WORD DEFINITIONS BY FUNCTIONAL CATEGORY

A. PURPOSE/OBJECTIVE

The purpose/objective for which the resource was created and/or the purpose(s) for which it might be useful.

Acquisition Strategy: The structuring of contracts and the procurement approach in a manner that will allow the Government to reduce program risk and to receive the most value per dollar spent. Examples of strategies are competition (versus single source) and multi-year procurements.

Competition Analysis: Analysis of the effects of having more than one source for military weapon systems, including answering the question of whether or not the initial investment required to establish and maintain competing contractors is less than the savings that result from negotiating cost in a competitive environment.

Cost Estimates/Analyses: Estimates of resource requirements to perform an activity or acquire a weapon system. Analyses of the reasonableness and validity of resource requirement estimates for military systems and programs.

Cost/Benefit Analysis: An analytical approach to solving problems of choice. It requires the definition of objectives, identification of alternative ways of achieving each objective, and the identification, for each objective, of that alternative which yields the required level of benefits at the lowest cost. It is often referred to as cost-effectiveness analysis when the benefits of the alternatives cannot be quantified in terms of dollars.

Data Base: A compilation of data for use in developing relationships, factors, or equations for analyzing cost. This includes cost data from contracts, cost/schedule reports and other sources, technical parameters and program data.

Economic Analysis: A systematic approach to the problem of choosing how to employ scarce resources and an investigation of the full implications of achieving a given objective in the most efficient and effective manner. The full problem is investigated; objectives and alternatives are searched out and compared in the light of their benefits and costs through the use of an appropriate analytical framework.

Financial Analysis: An appraisal of the dollar aspects of an operation or activity.

Manpower Estimates/Analyses: Estimates of manpower requirements to perform an activity. Analyses of the reasonableness and validity of manpower estimates for accomplishing a military activity or program.

Performance Assessments: A means of analyzing a contractor's performance on a contract, often to check the reasonableness of a contractor's estimate at completion (EAC). Cost Performance Reports (CPRs) are often used as a measure of cost and schedule progress on contracts. CPRs allow comparison of Budgeted, Actual, and Earned Value costs.

Planning/Programming/Budgeting: The establishment of long-range plans for weapon systems, defense organizations and force structures. The translation of plans into specific programs for their acquisition; and preparation of budgets to fund the programs and permit their execution.

Requirements Estimates/Analyses: Estimates the need or demand for personnel, equipment and supplies, resources, facilities or services, quantified and time-phased. Analyses of the reasonableness and validity of requirements estimates for accomplishing a military activity or program.

Risk Analysis: The evaluation of the situation, environment or conditions, particularly in conjunction with an estimate or analysis, to determine technical, financial, or business risks inherent in the activity or program. Approaches may extend from intuitive judgement and expert opinions through the use of complex models utilizing economic assumptions and/or probability distributions.

Schedule Estimates/Analyses: Estimates of realistic schedules obtainable for milestone events and activities of a program or project. Analysis of the reasonableness and validity of estimated schedules for military system or programs.

Software Sizing: Estimating the size (measured in source lines of code, deliverable source code instructions, etc.) of a software program. Size estimating models are often based on system attributes (e.g., number and type of functions), and may be used as an input into a software cost estimating model.

FIXED COSTS: An item of cost that is not considered to vary directly as a result of changes in volume of production; as opposed to variable and semi-variable costs.

INDIRECT COSTS: An item of cost which is incurred for joint usage, and, therefore, cannot be identified specifically with a single product, service program, function, or project. Usually used synonymously with overhead costs.

LCC: All costs (Government and contractors) incurred during the projected life of the system, subsystem, or component. It includes total cost of ownership over the system life cycle including the costs to develop, produce, operate, support, and dispose of a system, subsystem, or component.

LEASE COSTS: Cost of obtaining a lease (versus buy) procurement, which reduces overall program risk. The three major types are: operating, sale and lease-back, and financial or capital leases. Leasing can provide a lower initial Government outlay and shift the risk of obsolescence to the lesser.

MODIFICATION COSTS: Costs resulting from changes to an end item or an item of supply for any stated purpose.

O&S COSTS: The added or variable costs of personnel, materials, facilities, and other items needed for the peacetime operation, maintenance and support of a system during activation, steady state operation, and disposal.

PRODUCTION COSTS: Procurement appropriation costs associated with the fabrication, assembly, and delivery of a system in the quantities required to support DoD objectives. It includes the usable end item, support equipment, training, data, modifications, and spares.

R&D COSTS: All costs (Government and Contractual) required to develop a system before committing it to production.

C. TYPE OF DATA

COST DATA: The term given to cost statistics or records of a program and which usually have not been analyzed and organized into cost information.

EQUIPMENT HOUR DATA: Statistics or records of the operating hours for equipment, including time system is operational and time it is under repair and maintenance.

LABOR HOUR DATA: Statistics or record of number of personnel hours expended for specific tasks.

MANPOWER DATA: Statistics or records of the availability or need for personnel for particular tasks or force structures.

PROGRAM DATA: Information by estimator to properly phase the estimate, understand interrelationships with other systems, and to ensure inclusion of all cost elements. Some of the critical programmatic data sources that come from the program offices are: Program Management Directive and Form 56, Test and Evaluation Master Plan (TEMP), Total Program Schedules (FSD and Production), current Program Estimate, Approved Program Funding, Integrated Logistic Support Plan (ILSP), List of ECPs (with values and contractual status), Basing/Deployment Plan, Program Management Plan (PMP), Program Acquisition Plan.

SCHEDULE DATA: Information on the milestone events and activities of a program or project.

TECHNICAL CHARACTERISTICS DATA: Physical aspects of a system (e.g., weight, volume, power, etc.) that are often used as cost drivers (independent variables) in cost estimating relationships.

D. ANALYSIS TECHNIQUES

ANALOG TECHNIQUES: Estimating method that uses actual costs of a similar existing or past programs and adjusts for complexity, technical, or physical differences to derive the new system estimate.

CONTRACT ANALYSIS: Evaluation of contractor cost data by evaluating the costs appearing in the contract and as modified by contract modifications.

CONTRACTOR DATA ANALYSIS: Evaluation of contractor cost data through the reporting structure used in DoD procurements consisting of specific definitions, requirements, and formats.

CURVE FITTING: A means of defining a relationship for a set of bivariate data. One method is by visually inspecting the data as shown in a scatter diagram and drawing a suitable curve roughly along the central axis of the area containing the data points. Another approach is the least squares method, where calculations are performed to obtain the curve through the data that minimized the sum of the n square vertical distances.

ECONOMETRIC FORECASTING: Econometrics is the art of quantifying an economic process by describing the process in terms of a functional relationship. Forecasting is performed by varying the independent variable in the equation to assess how the dependent variable responds, while the other relevant variable are held at specified levels. Econometric forecasting offers a quantitative estimate of the outcome and provides a technique for holding other variables constant. There are three broad categories of econometrics: 1) descriptive statistics, 2) nonparametric techniques, and 3) parametric techniques. Regression analysis is a popular form of econometric forecasting.

Contract Analysis: Evaluation of contractor cost data by evaluating the costs appearing in the contract and as modified by contract modifications.

Contractor Data Analysis: Evaluation of contractor cost data from reports obtained through the reporting structure used in DoD procurements consisting of specific definitions, requirements, and formats.

Curve Fitting: A means of defining a relationship for a set of bivariate data. One method is by visually inspecting the data as shown in a scatter diagram and drawing a suitable curve roughly along the central axis of the area containing the data points. Another approach is the least squares method, where calculations are performed to obtain the curve through the data that minimizes the sum of the squared vertical distances.

Econometric Forecasting: Econometrics is the art of quantifying an economic process by describing the process in terms of a functional relationship. Forecasting is performed by varying the independent variable in the equation to assess how the dependent variable responds, while the other relevant variables are held at specified levels. Econometric forecasting offers a quantitative estimate of the outcome and provides a technique for holding other variables constant. There are three broad categories of econometrics: 1) descriptive statistics, 2) nonparametric techniques, and 3) parametric techniques. Regression analysis is a popular form of econometric forecasting.

Engineering Build-up Techniques: Also called "grass roots" estimating, this technique performs an estimate at the functional level of the WBS. Using manloading, engineering standards, and actual cost detail, the individual parts of the system are estimated and then aggregated to the system-level cost estimate.

Monte Carlo Simulation: The Monte Carlo approach uses computer simulation to obtain approximate solutions to mathematical or physical problems. For cost risk analysis, the distribution defined for each cost element is treated as a population from which several random samples are drawn. The procedure is repeated several times, resulting in a normal distribution of random total costs which can be described by its mean and standard deviation.

Parametric Techniques: These techniques employ program, physical or performance characteristics (parameters) as independent variables in the development of mathematical cost estimating relationships for cost of an item using relevant historical data bases.

ESCALATION/INFLATION FACTORS & INDICES: An index of prices showing the percentage change of prices from one point in time to another, often used to adjust costs to a constant base year for comparison purposes.

LEARNING CURVES: The cost quantity relationship for estimating cost of equipment. Generally used to predict or describe the decrease in the cost of a unit as the number of units produced increases.

MANPOWER ESTIMATING RELATIONSHIPS (MERs): Equations to predict available manpower as a function of some determining factor, e.g., retention rates, population, recruits.

PLANNING FACTORS: A cost estimating relationship in which cost is directly proportional to a single independent variable. A brief arithmetic expression wherein cost is determined by application of a factor such as a percent, e.g., initial spares percent, general and administrative percentage, or a ratio as in pay and allowance cost per person per year.

SCHEDULE ESTIMATING RELATIONSHIPS (SERs): A functional expression of schedule (measured in months, years, etc.) is relating to a driving factor (e.g., number of personnel on the project).

WEIGHT ESTIMATING RELATIONSHIPS: A functional expression of weight as related to independent variables (usually technical parameters of the equipment to be estimated).

F. COST/WORK BREAKDOWN STRUCTURE

COST OF MONEY (COM): The cost of capital committed to facilities as an element of contract cost.

ENGINEERING: The effort and costs expended in the scientific exploration, study, analysis, design, development, evaluation, and redesign of a specific task or work breakdown structure element. It includes the preparation of specifications, drawings, parts lists, wiring diagrams, technical coordination between engineering and manufacturing, supplier coordination, test planning and scheduling, analysis of test results, data reduction and report preparation. Also includes the determination and specification of requirements for reliability, maintainability, and quality control. It is a basic functional cost category or cost element.

ENGINEERING CHANGE ORDERS (ECO): Orders to alter the physical or functional characteristics of a system or item delivered, or under development, after establishment of such characteristics.

FACILITIES: A physical plant which provides the means for assisting or making easier the performance of a function, e.g., base, arsenal, factory. Any part or adjunct of a physical plant, or any item of equipment in an operating entity and which

Planning Factors: Cost factors designed to permit quick-response estimates for use in planning, trade-off analyses and budget exercises. Approved factors may be published in the form of manuals for budgeting, particularly for operations and maintenance.

Schedule Estimating Relationships (SERs): A functional expression of schedule (measured in months, years, etc.) as related to a driving factor (e.g., number of personnel on the project).

Weight Estimating Relationships (WERS): A functional expression of weight as related to independent variables (usually technical parameters of the equipment to be estimated).

F. COST/WORK BREAKDOWN STRUCTURE

Detailed information on specific cost/work breakdown structure elements that are addressed in the resources. These elements may be of special interest, unusual, hard-to-find or have other characteristics worthy of mention so that they can be readily located.

Data: All graphic and written information, whether technical or nontechnical. Data may be in the form of drawings, documents, reports, letters, machine printouts, brochures, and other applicable forms not specifically mentioned. Usually controlled by the Contract Data Requirements List (CDRL) attached to a contract.

Engineering: The effort and costs expended in the scientific exploration, study, analysis, design, development, evaluation, and redesign of a specific task or work breakdown structure element. It includes the preparation of specifications, drawings, parts lists, wiring diagrams, technical coordination between engineering and manufacturing, supplier coordination, test planning and scheduling, analysis of test results, data reduction and report preparation. Also includes the determination and specification of requirements for reliability, maintainability, and quality control. It is a basic functional cost category or cost element.

Engineering Change Orders (ECO): Orders to alter the physical or functional characteristics of a system or item delivered, or under development, after establishment of such characteristics.

LABOR/MATERIALS BREAKDOWN: Visibility is provided into what resources are expended for labor (e.g., engineering) and what are expended on actual physical inputs required in the development or production of an item.

MAINTENANCE: All actions performed either: 1) when necessary, as a result of failure, to restore an item to a specified condition, ore 2) at scheduled points in time to retain an item in a specified condition by providing systematic inspection, detection, and prevention of incipient failures.

MANAGEMENT RESERVE: A term limited to contractors which represents a value within the negotiated contract target cost that the contractor has decided not to initially distribute to his/her functional departments.

MANUFACTURING: The effort and costs expended in the fabrication, assembly, and functional testing of a product or end item. Includes all the processes necessary to convert raw material into finished items delivered to a customer's specification. In most companies it is a basic functional cost category.

MARKUP: The amount added to the cost to cover overhead and profit in arriving at the selling price.

NONRECURRING/RECURRING BREAKDOWN: Those elements of cost which generally occur only once (nonrecurring) and those which occur repeatedly (recurring) during the production and delivery of a weapon or support system. Nonrecurring elements include basic design and development, configuration audits, qualification testing, prototypes, and engineering models. Recurring elements include fabrication, assembly, manufacturing, sustaining engineering and planning, sustaining tooling, acceptance testing of production items, and systems engineering/program management.

OVERHEAD: A cost which, because of its incurrence for common or joint objectives, is not readily subject to treatment as a direct cost. Such indirect cost is incurred to benefit the total direct cost or business base of a contractor. The character of overhead cost thus requires estimating, budgeting and control techniques that take into account the total business base of a contractor. Accordingly, the overhead applicable to any one estimate or contract is by an appropriate distribution of indirect costs through the use of a rate per hour or percentage applied to direct hours or costs. Indirect is a term which is synonymous with overhead.

SUPPORT EQUIPMENT: Refers to those items required to support and maintain the system or portions of the system while not directly engaged in the performance of it mission, and which have application peculiar to a given defense materiel item. Includes vehicles, equipment, tools, etc., used to refuel,

disassemble, test, inspect, or otherwise maintain the mission equipment. Also includes all effort associated with the design, development, and production of peculiar support equipment.

PERSONNEL: Personnel acquisition costs include the costs for recruiting, basic training, accession travel, temporary duty, initial clothing, education and training, and miscellaneous allowances. Training costs include costs of preparing personnel for active duty, e.g., undergraduate pilot training, enlisted specialty training.

PROCUREMENT SUPPORT: Those elements besides that basic hardware procurement costs that are necessary for acquisition, including: project management/systems engineering, special tools/test equipment, Government test and evaluation, data, etc.

PROFIT: Generally characterized as the basic motive of business enterprises the excess of the revenues from sales of goods to services over the related cost thereof in a given transaction or over a given period of time. The work "profit" is used in fixed price type contracts versus "fee" in cost type contracts.

PROTOTYPE: A largely hand-built original or model of a final product that is subject to full service test.

SITE ACTIVATION: Refers to the real estate, construction, conversion, utilities, and equipment to provide all facilities required to house, service, and launch prime mission equipment. Includes conversion of site, ship, or vehicle, system assembly, checkouts, and installation into site facility or ship to achieve operation status. Also includes contractor support in relation to operational/site activation.

SPARES: A term sometimes used to denote a portion of "spare parts" represented by subassemblies and assemblies or major components (like aircraft engines, boosters, etc.); an abbreviated work for spare parts.

TEST & EVALUATION: Refers to the use of prototype, production, or specially fabricated hardware to obtain or validate engineering data on the performance of the system. Includes the detailed planning, conduct, support, data reduction and reports from such testing, and all hardware items which are consumed or planned to be consumed in the conduct of such testing. Also includes all effort associated with the design and production of models, specimens, fixtures, and instrumentation in support of the test program.

TOOLING & TEST EQUIPMENT: Both the specialized tools unique to a program and the electrical, electronic, or mechanical items used to support the performance and testing of a contract.

TRAINING: Cost of preparing personnel for the operation of a system, including training materials and instruction time.

Prime Mission Equipment (PME): Equipment and associated computer programs used to accomplish the prime mission of the defense materials item. It also includes such items as interconnecting cabling and harnesses.

Procurement Support: Those elements in addition to the basic hardware procurement costs that are necessary for acquisition, including: project management/systems engineering, special tools/test equipment, Government test and evaluation, data, etc.

Profit: Generally characterized as the basic motive of business enterprises. The excess of the revenues from sales of goods and services over the related cost thereof in a given transaction or over a given period of time. The word "profit" is used in fixed price type contracts versus "fee" in cost type contracts.

Prototype: A largely hand-built original or model of a final product that is subject to full service test.

Site Activation: Refers to the real estate, construction, conversion, utilities, and equipment to provide all facilities required to house, service, and launch prime mission equipment. Includes conversion of site, ship, or vehicle, system assembly, checkouts, and installation into site facility or ship to achieve operation status. Also includes contractor support in relation to operational/site activation.

Spares: The portion of "spare parts" represented by subassemblies and assemblies or major components (e.g., aircraft engines, boosters, etc.). Includes initial (investment) spares as well as replenishment (expense) spares).

System Level Breakdown: Breakdown of system (program) level costs that apply to the system as a whole and are not attributable to specific items of prime mission equipment. Includes such categories as Systems Engineering/Program Management, System Test & Evaluation, Data and Training.

Test & Evaluation: Refers to the use of prototype, production, or specially fabricated hardware to obtain or validate engineering data on the performance of the system. Includes the detailed planning, conduct, support, data reduction and reports from such testing, and all hardware items which are consumed or planned to be consumed in the conduct of such testing. Also includes all effort associated with the design and production of models, specimens, fixtures, and instrumentation in support of the test program.

Tooling & Test Equipment: Both the specialized tools unique to a program and the electrical, electronic, or mechanical items used to support the performance and testing of a contract.

Training: Cost of preparing personnel for the operation of a system, including training materials and instruction time.

Warranty Costs: Costs of contractor warranties that specify time periods for defect-free performance and remedies when products/supplies/services are found to be defective. Includes Reliability Improvement Warranties (RIWs) or Product Performance Agreements which are contractual agreements requiring the contractor to assume responsibility for the field performance of the product after delivery.

WBS: A work breakdown structure which outlines the elements of a Statement of Work. A product oriented family tree comprised of hardware, software, services and other work tasks which completely displays the project/program. A management technique for subdividing a total job into its component elements.

G. EQUIPMENT COVERED

The specific hardware or software systems that are the subject of the resource.

ADA: Ada is a concept as well as a programming language which highly emphasizes reuse, object orientated design, complete and thorough requirements definition, and portability. It is specifically intended to support modern programming techniques such as structured programming, information hiding, abstract data types, and concurrent processing. DoD Directive 3405.1 requires Ada to be used on all applications except those that are proven to be more cost effective, over the life cycle, if written in another higher order language.

Aircraft: Fixed or movable wing, rotary wing, or compound wing, manned air vehicles designed for powered or unpowered (glider) guided flight in the atmosphere.

Airframes: The assembled structural and aerodynamic components of the air vehicle that support subsystems essential to a particular mission. It includes, for example; the basic structure (wing, empennage, fuselage, and associated manual flight control system), the air induction system, starters, exhausts, the fuel control system, inlet control system, alighting gear (tires, tubes, wheels, brakes, hydraulics, etc.), secondary power, furnishings (cargo, passenger, troop, etc.), environmental control, racks, mounts, intersystem cables and distribution boxes, etc., which are inherent to and nonseparable from the assembled structure, dynamic systems, rotor group, and other equipment homogeneous to the airframe.

NAVIGATION: Equipment utilized in locating the position and plotting the course of ships and aircraft.

PRECISION-GUIDED SUBMUNITIONS: Any of a number of "smart bombs" capable of seeking difficult targets through use of seekers, etc.

RADAR: Any of several systems or devices using transmitted and reflected radio waves for detecting a reflecting object, as an aircraft, and determining its direction, distance, height, or speed, or in storm detection, mapping, navigation, etc.

RPV: Remotely-piloted vehicle

SENSOR: Refers to those equipments which are used to extend man's natural senses; and equipment which detects and indicates terrain configuration, the presence of military targets, and other natural and manmade objects and activities by means of energy emitted or reflected by such targets or objects.

SHIPS: Refers to the waterborne vehicle of a ship system. Includes all types of surface and subsurface water vehicles such as combatants, auxiliaries, amphibious, and special-purpose ships. Includes all material and effort associated with the design, development, production, testing, and delivery of complete ships. Also includes spares, repair parts, and support equipment carried onboard the ship.

SOFTWARE: Having to do with computer programs and instructions. In a general sense- reports, drawings, sketches, computer programs or tapes, photos, etc., as opposed to hardware.

SOFTWARE (EMBEDDED): Having to do with the computer programs which are embedded in a system, and are not easily transferable to another system (e.g., the software used in the operation of a particular weapon system.)

SONAR: An apparatus that transmits high-frequency sound waves through water and registers the vibrations reflected from an object, used in finding submarines, depths, etc.

SPACE SYSTEM: Refers to the complex of hardware, data services, and facilities required to develop and produce the capability for the placement, operation, and recovery of manned and unmanned vehicles in space. Includes launch/stage vehicles, space vehicles, support equipments, and other elements necessary to provide an operational space system.

SPACECRAFT: Refers to the principle operating space vehicle which serves as a housing platform for carrying a payload and other mission-oriented equipments into space. Includes the structure/spaceframe, electrical power and distribution, attitude controls, command and control, and other equipments homogeneous to spacecraft. Also includes all effort associated with the design, development, production, and assembly of spacecraft.

STRATEGIC DEFENSE: Relating to the Strategic Defense Initiative (SDI), or "Star Wars", under which defense against nuclear attack occurs in space.

SUPPORT EQUIPMENT: Includes all equipment required to perform the support function except that which is an integral part of the mission equipment. It does not include any of the equipment required to perform mission operation functions. Support equipment includes handling equipment, test equipment, automatic test equipment, organizational, field, and depot support equipment, tools, and related computer programs, and software. Further, it consists of peculiar support equipment (PSE) which is unique to a system and common support equipment which is in the customer inventory.

VEHICLES (TRACKED): A mobile ground unit (truck, tank, etc.) which is propelled by tow continuous roller belts, and can move over rough ground.

VEHICLES (WHEELED): A mobile ground unit (truck, tank, etc.) which is propelled by wheels.

WEAPON SYSTEMS: The sum total of prime mission equipment and all the peripheral elements that are necessary to operate and maintain the equipment as a mission-ready unit. Weapon system includes support equipment, spares, supplies, trainers, people, tech orders, and facilities. Often referred to as the "system".

APPENDIX F
LIST OF INITIAL SURVEY SOURCES

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